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PREFACE

The complexities of modern managerial practice have brought about significant changes in the position and function of the cost accountant. He is no longer merely a recorder of data; he is an interpreter of these data for management and himself plays an important part in the formulation of policy. It is becoming increasingly important that anyone with an interest in business management should be acquainted with the techniques of cost accounting, and that the prospective accountant should understand the uses to which his techniques will be put.

With these considerations always before them, the authors have drawn upon their combined experience as teachers, practitioners, and research specialists to make this book suitable for students who expect to enter business or industry as well as for those who plan to become accountants. The main purpose has been to achieve a proper balance among the following objectives: (1) the function of cost accounting as a tool of management; (2) the specific procedures and mechanics by which cost accounting can implement managerial control in accordance with accepted up-to-date business practice; and (3) the reasons, based on sound theory, which underlie the adoption of recommended procedures.

In the interest of achieving this up-to-date and balanced treatment a number of important innovations have been made. Process costs are introduced and given a full treatment early in the book. This enables the student to become acquainted as soon as possible with the operation of a simple cost system; at the same time it reflects the recent trend in industry toward wider use of process costing. Job order costing is covered later in a separate chapter which stresses the interaction of production control with job order accounting. The chapters on material, labor, and overhead accounting are presented without reference to any particular type of cost system.

The widespread use of standard costs as a technique for cost control makes it important that anyone who has dealings with manufacturing industry should have a thorough understanding of this subject. The chapters on standard costs in this book represent the most extended treatment available in a general textbook on cost accounting. They cover current standards as well as measurement standards and give a complete demonstration of each method for the same set of transactions. An important feature is the application of standard cost techniques to such fields as joint products, by-products, and distribution cost accounting.

The increased use of forward planning in industry has emphasized the need for the budgeting of costs and income. In planning, the weaknesses of the older fixed budgets are now apparent, and extensive application of cost–volume–profit analysis is being made to provide plans which are flexible in relation to volume of business. Techniques like the break-even chart, marginal income analysis, and analysis of profit variances are now widely used as tools of cost accounting. This book contains an up-to-date chapter on these techniques and their application. The subject of the analysis of comparative costs and income for alternative courses of action is also given special treatment. A sound knowledge of this area of cost accounting has become essential for making managerial decisions involving both long-range planning and day-to-day operations.

Many practical problems, of varying length and difficulty, are provided for each chapter. Three practice sets, covering process costs, job order, and standard costs, are packaged separately to allow for flexibility in their use. They represent case studies which have been simplified to meet student requirements but retain the practical features which give a sense of reality and immediacy. The first set can be introduced early—as soon as the chapter on process costs has been covered—and can be gradually completed while the chapters on material, labor, and overhead are being studied. Each set has been thoroughly tested with students in the classroom.

The question of terminology is always a troublesome one for accountants. The terminology used here is that approved by the American Institute of Accountants and the National Association of Cost Accountants as shown in various research bulletins of those bodies.

It is difficult to know where to start in making acknowledgments. The authors' thanks are extended to the National Association of Cost Accountants which through its National Secretary, Arthur Gunnarson, and its Assistant Secretary, Dr. Raymond P. Marple, has been most generous in making available to them material appearing in its research reports, bulletins, and conference proceedings. Special thanks are extended to Gilbert Amerman of the research staff of the National Association of Cost Accountants for contributing standard cost problems and for patiently unraveling the mathematics of profit variation analysis so that the subject could be presented in simplified form. The authors gratefully acknowledge their indebtedness to the American Institute of Accountants for granting permission to use problem and question material. Thanks are also due to Charles H. Gleason, Plant Comptroller of

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COST ACCOUNTING

Chapter 1

NATURE AND SCOPE OF COST ACCOUNTING

Nature of Cost Accounting. Cost accounting is an accompaniment of a movement in industry to which the general name of scientific management has been given. Actually the development of cost accounting from a purely clerical function to its present position as an important tool of managerial control reflects in good measure the historical development of scientific management in industry. It is the aim of scientific management to make the most efficient use of the production facilities consisting of plant and machinery, tools, materials, and manpower. The cost accountant brings together the records of performance for this purpose and submits them together with his interpretive comments to management.

Relationship Between Cost and Financial Accounting. Financial accounting is commonly viewed as being concerned primarily with transactions between the business and outsiders. The results of the operations are presented in the profit and loss statement classified by main divisions, such as manufacturing, selling, and administration. Cost accounting, on the other hand, deals largely with internal transactions. Thus financial accounting records contributions of capital, the purchase of assets, the payment of expenses, the sale of goods, and the collection of money from customers. Cost accounting records the processes by which costs of materials, labor, and services are embodied in inventories and the costs of selling goods from these inventories. Financial accounting records payments and accruals for costs. It also provides in totals the profit or loss figures resulting from operations. However, it does not permit management to follow costs of manufacturing and selling operations step by step in order that it may know exactly how the profit or loss arose. This is the field of cost accounting.

Definition of Cost Accounting. Cost accounting may best be defined as *a specialized technique for obtaining, through the double-entry process, the cost of a manufactured product or of a service according to* *some scheme of functional classification.* While definitions are necessary in delimiting a subject, they sometimes raise new problems which in turn require explanation. It therefore becomes necessary to examine each phrase of the above definition and explain it in more detail.

SPECIALIZED TECHNIQUE. Cost accounting, as already noted, is designed to complement financial accounting. It deals with the processes of measuring, classifying, recording, reporting, and interpreting business costs in such a manner that unit costs of products or services may be obtained. The particular methods by which this is accomplished constitute the subject matter of later chapters. The techniques in a given case may be simple or complex depending upon the number of manufacturing processes, their technical complexity, and the degree of detailed information desired. The system, which represents the sum of the techniques and procedures employed, must be made to fit the individual peculiarities of a plant in order to yield the information and control over operations sought by the management.

DOUBLE ENTRY AS RELATED TO COST PROCEDURES. Cost accounting rests on the same principles concerning debits and credits which are found in general accounting. The same records are used; but over and above these general books there is imposed another group of forms and records dealing more specifically with aspects of costs constituting the field of study of cost accounting. Two points, particularly, must be kept in mind in this connection. First, the gathering of cost information must be provided for in such detail as to furnish proper guidance to management in reaching decisions based on sound knowledge. Second, the recorded information must be kept under strict control in conformity with double-entry principles. This is most often accomplished through the use of so-called cost controlling accounts and their related subsidiary ledgers.

It is not to be concluded, however, that the double-entry process is the only method by which costs are computed. For cost recording purposes the limitations imposed by double entry must be observed, but a great deal of cost calculating goes on independently of the existence of cost records. In fact, it may be, and frequently is, carried on where no formal cost system exists. Such work is sometimes referred to as statistical costing, or more particularly as cost finding and cost estimating.

COST. A cost accountant, dealing for the most part in money values, thinks of cost as an outlay or expenditure made to acquire goods or services. In this sense it is merely a money consideration given in exchange for something of value to the business. But this, in itself, is not sufficient to define the term. The word "cost" has become part of the technical vocabulary; it is used in many senses, sometimes referring to an outlay which results in a product, sometimes to an outlay whose end result is a charge to profit and loss. It is for this reason that when the word "cost" is used, it is usually preceded or followed by other words which are helpful to an understanding of the term. Material costs, conversion costs, cost accounting, cost systems, cost statements, cost departments, historical costs, and standard cost are illustrations of the manner in which the word is used.

The upshot of all this is that the cost accountant, instead of defining cost in the abstract, deals with specific situations by employing cost formulas to suit each case. These formulas define for each situation what is to be included in the cost of a product. In fact, the cost accounting student should realize at an early stage that the same item may have different costs *depending upon the purpose the cost is to serve,* that is, the *use* to which it is to be put. Thus an item may have one cost for pricing purposes and a different cost for tax purposes. A cost is therefore not something exact; even so-called actual costs contain a large element of judgment. Hence, because cost cannot be defined precisely, cost accounting must not be thought of as an exact science, but as a flexible tool to be used by the cost accountant according to his best judgment and the governing circumstances.

MANUFACTURED PRODUCTS AND SERVICES. Historically, cost accounting has been generally associated with manufacturing operations. Indeed, it is in the latter field that cost accounting has reached its highest development. There is no reason, however, why its principles and procedures may not be applied to other fields. Even within a manufacturing plant, the cost accountant is concerned, as part of the job of determining the cost of a manufactured product, with the costs of various services. For example, it is necessary to know the cost of producing power, of making tools, dies, jigs, and fixtures to be used in the manufacture of the product. The cost accountant also wants to know the cost of operating such services as the tool crib, the storage room, the payroll department, the planning and production control section. These are all examples of *services* whose costs must be known in order to be able to judge the relative efficiency with which they are being performed.

Another area in which cost accounting is useful is in the field of marketing and administrative expenses. Here the work that has been done is of quite recent origin and has therefore not been developed to the same degree of refinement as in the manufacturing part of the business. Progress has been made, however, in such directions as determining the cost of servicing customers according to size of order, products, salesmen, and other classifications.

Finally, cost accounting has been found useful in other fields. For example, it may be used to advantage in department stores, banks and trust companies, motor trucking, public utilities, even in professional offices, such as lawyers and accountants. In short, cost accounting has a universal appeal, giving it a vast area of usefulness entirely aside from the important role it plays in manufacturing.

Functional classification. Functionalism in cost accounting represents an attempt to classify costs according to the purposes which they serve. Expressed in simple terms, this boils down to a classification of accounts by departments, by specific orders, by products, etc. More detailed treatment is given to this subject in a later chapter dealing with cost classifications.

Basic Functions of Cost Accounting. Broadly speaking, cost accounting is intended to fulfil the following objectives:

1. To aid in determination of profit or loss including inventory valuation
2. To aid management in planning
3. To control operating efficiency

Since each one of these uses raises different problems, they are discussed separately below. However, in reality they constitute the subject matter of the entire book. The chapters which follow are only an expansion of these three topics, because cost accounting techniques must always be adapted to the purposes for which costs are to be used.

Measuring profit or loss. The determination of the proper cost (or replacement value) of inventories has a direct effect upon the profit or loss which has resulted from making and selling goods. In order to do this, it is necessary to ascertain the *actual cost* of manufacturing the goods which were sold. Since this cost is determined after the goods have been made it is sometimes called the *historical cost.* Selling costs determined after the goods are sold are likewise termed actual or historical selling costs.

The process of measuring actual cost begins by recording the costs of operating the factory for the period. A portion of these costs applies to the goods which have been sold, whereas another portion of the costs is represented by inventories of merchandise still on hand in the factory or finished goods warehouse. Hence it is necessary to calculate the part of the total manufacturing cost which applies to cost of sales and that part pertaining to inventories. Costs of selling and of general administration are likewise recorded, although these costs are not usually included in the inventories.

AID TO MANAGEMENT IN PLANNING. Before deciding to produce a given article, management needs to know what it will probably cost to make and sell the item. It must therefore plan its work along three lines:

1. Preparation of a budget
2. Determination of a selling price
3. Decision concerning desirability of alternative courses of action

The successful business is one which plans its production, sales, and profits, as well as its financial position. These plans are embodied in a budget, and in its preparation the cost accountant plays an important role. He aids in planning production and setting limits for the costs of the planned production. In this work he must take account of the volume of production and past costs, modifying the latter in the light of expected conditions. These cost figures, looking to the future, are called estimated or *predetermined* costs, since they are determined *before* the work is started.

Such predetermined costs can then be compared with the expected prices of products to determine the profitability of each product. But setting selling prices is itself a major undertaking. It is a common saying that competition sets selling prices. This, as every student of economics knows, is only a partial truth. For short periods of time, competition may in fact set prices, even below the point representing the cost of production. The continued financial welfare of a business demands, however, that long-range objectives be marked out and that prices be set so that in the long run selling prices will show a margin over the costs to make and sell the different products. On the other hand, many products are sold on the basis of actual production costs. An outstanding illustration is the sale of a product on a cost-plus basis, whereby the vendor receives the cost plus a stated percentage of profit. During World War II this type of contract was outlawed, but its place was taken by the cost-plus-fixed-fee contract, commonly referred to as the CPFF contract. Finally, it may be said that selling prices for highly specialized products, particularly products manufactured to customers' specifications, are usually based on estimated costs of production.

It is only by such advance calculations that the activities of the business can be directed into the most profitable channels. Moreover, once it has been decided to manufacture a given product, it can usually be made by different methods and it is necessary for management to decide which combination of materials, men, and machines to use. Again it becomes necessary to determine what it will cost to make the article by each of the methods under consideration in order that the most economical way to accomplish the desired results may be chosen.

Most of the planning done by management is a matter of choosing which course of action to pursue when there are two or more ways of accomplishing a task. In choosing between the alternatives presented, cost is usually an important consideration. Decisions reached in this connection frequently involve matters of company-wide policy. For example, top management may have to decide whether it is cheaper to shut down the plant completely or continue to operate at a loss; or whether it is cheaper to buy certain parts or to manufacture them in their own plant.

CONTROL OF OPERATING EFFICIENCY. In order that management may know whether or not the various divisions of the business are operating efficiently, it is necessary to determine whether or not costs of operation are as low as they should be. This requires first a knowledge of how much it ought to cost under existing conditions to do the work. Here again predetermined costs are needed. When these costs have been carefully developed, they are called *standard costs.* The actual costs of production are then compared with the standard costs in order to see why the actual cost of the product is higher or lower than the cost which was anticipated. As a result of this comparison, it may appear that proper methods are not being followed or that the wrong type of materials is being used and it may be possible to take corrective action to save further unnecessary expense.

By virtue of cost information in the hands of plant superintendents, department foremen, and other minor executives, there is at all times a combined subconscious effort to reduce cost. Steady application of cost figures to factory operation becomes a natural part of the operating routine and savings are frequently put into effect which can be measured and discussed at meetings. In common with other business procedures, cost figures soon become an accepted part of regular operation.

Advantages of Cost Accounting. Many limitations of financial accounting may be overcome by a well-designed cost accounting system. In a sense, the reasons for cost systems set forth above also provide the basis for their advantages. The above objectives may therefore be elaborated to yield the following advantages of cost accounting:

1. *More accurate unit costs.* The chief criticism leveled against financial accounting is based on the fact that the records furnish information concerning total costs only. While this may suffice in simple cases, the method breaks down as soon as more than one product is produced. When such a condition arises, information concerning the unit cost of each product can be obtained only if the values embodied in each product are known, and that is precisely the sort of information to be gleaned from a cost system.

2. *Presentation of more frequent and more accurate financial statements.* A frequent criticism against the financial accounting procedure is that it becomes necessary to take physical inventories before even over-all costs can be determined. The taking of physical inventories is an arduous, time-consuming task, necessitating sometimes the shutting down of a plant. It must be obvious that such a job cannot be undertaken often, and yet unless it is done, it is not possible to supply a profit and loss statement often enough to serve as a guide to management. To take stock once or twice a year is as much as the average concern can be expected to do; and yet statements, to be of any use, should be furnished at least once a month. A cost system, on the other hand, automatically furnishes closing inventory figures by tracing the flow of the product, and recording the cost at each step. Particularly, perpetual inventory records used in conjunction with a cost system set forth what should be in the inventory. The physical inventory is used for purposes of verification and determination of inventory shortages and overages.

3. *Establishment of control over costs.* It is the province of cost accounting to assign costs to particular segments. The segments may be grouped by cost elements, by various functions, or by products, but it is on the basis of cost assignment that management is able to exercise its informed judgment.

4. *Development of cost calculations for new products and designs,* in order to guide management in its efforts to determine the profitableness of proposed changes in products and designs.

5. *Development of cost comparisons,* enabling the management to note efficient as well as inefficient performance and to institute procedures for encouraging the former and reducing the latter. These inefficiencies are costly and are caused by material wastage, use of obsolete machinery, poor planning, or assigning of men to work for which they are not qualified.

The cost comparisons are of three types: geographical, time, and comparisons with standard. In the first type, comparisons are made of the figures for different branches or assembly plants of a company. In the second, costs of a plant or department are compared with those of a month ago, a year ago, or with the cumulative costs for the year. However, both types of comparisons are often unsatisfactory since they may hide inefficiencies contained in the figures rather than reveal them. The best type of comparison is one against a carefully predetermined standard which represents normal performance. In this way real progress can be made in the fight to eliminate all forms of waste.

Place of Cost Department in Organization. Opinion has been divided among accountants, industrial engineers, and factory executives as to the place of the cost department in the organization plan and the responsibility for its direction. In the resulting discussions two ideas have been advanced:

1. Cost department as a factory department
2. Cost department as an adjunct to the general accounting department

The cost accounting department should occupy a place in the organization which enables it to serve as a ready source of accurate and unprejudiced cost information on all activities of the business and it is therefore suggested that it be placed in the accounting department as illustrated in Figure 1.

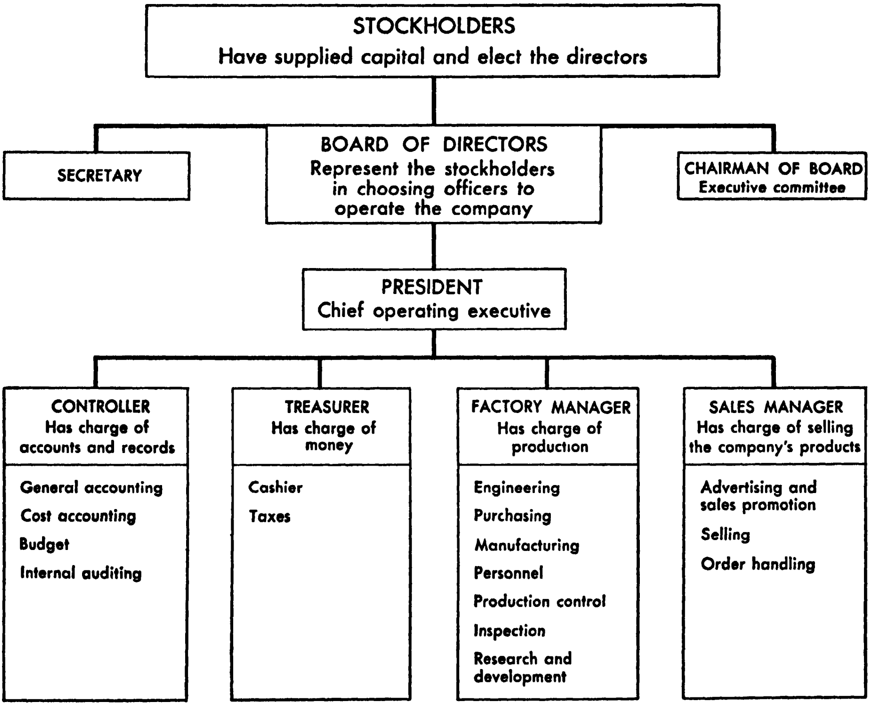


FIGURE 1. Organization of a Manufacturing Company

In this chart, cost accounting is shown as one of the functions of the controller, who is the chief accounting officer. With this plan of organization all accounting work is integrated and responsibility for the accounts is centered in the controller. Since cost accounting is but one aspect of general accounting it is only logical to bring all activities of accounting under one head. There are, however, some companies which place cost accounting under the jurisdiction of the factory for the reason that factory management needs the information to guide its activities.

Figure 2 shows in detail the most common functions ordinarily coming within the jurisdiction of the controller. These are discussed below.

General Accounting Department. This department performs numerous accounting functions and coordinates all accounting work and data as indicated in the following list of its most important duties:

1. The handling of all detailed accounting papers not passing through or recorded by the cost department, such as purchase invoices, sales invoices, general journal vouchers, and cash receipts and disbursements. The cost department receives memoranda of all transactions affecting the cost of production and the expenses of operating the various departments of the business. Detailed accounting papers handled by the cost department are summarized by it and the summaries, frequently in journal entry form, are passed to the general accounting department for entry in the appropriate books of account.
2. The maintenance of the controlling books of account, such as the general ledger and the accounts receivable and other ledgers, and of the books of original entry, such as the voucher register and general journal. The detailed stock records are likely to be maintained in other departments as previously recommended, but are nevertheless a part of the books of account and under functional accounting control. The various accounting papers mentioned in the preceding paragraph and the summaries of cost and expense elements prepared by the cost department are recorded in these books of account.
3. The plant asset records. Depreciation charges on machinery and equipment are accumulated from these records and reported to the cost department, and the latter in turn reports data for repairs, additions, and disposals originating in the factory cost accounting records.
4. The preparation of balance sheets and profit and loss statements. Data supplied by the cost department are vital to preparation of these statements, e.g., cost of sales and inventory valuation.
5. The compilation of sales and other control statistics. Costs of products sold and many data for these and other statistical analyses originate in the cost department.
6. The compilation of tax statements. Tax and other government statements require data to be prepared in certain formats and the amount of taxes paid depends, in part, upon the proper treatment of expenses in accordance with the law.

The above definitely indicates the close relationship between general and cost accounting; neither activity can carry on its work without the closest cooperation of the other.

Cost Accounting Department. The work of the cost department is outlined in Figure 2. In this department there are tasks which vary in their demands for technical knowledge, skill, judgment, initiative, and responsibility. The task of the cost accountant may be summarized from Figure 2 under the following heads:

1. Recording information
2. Analysis of costs
3. Administrative work

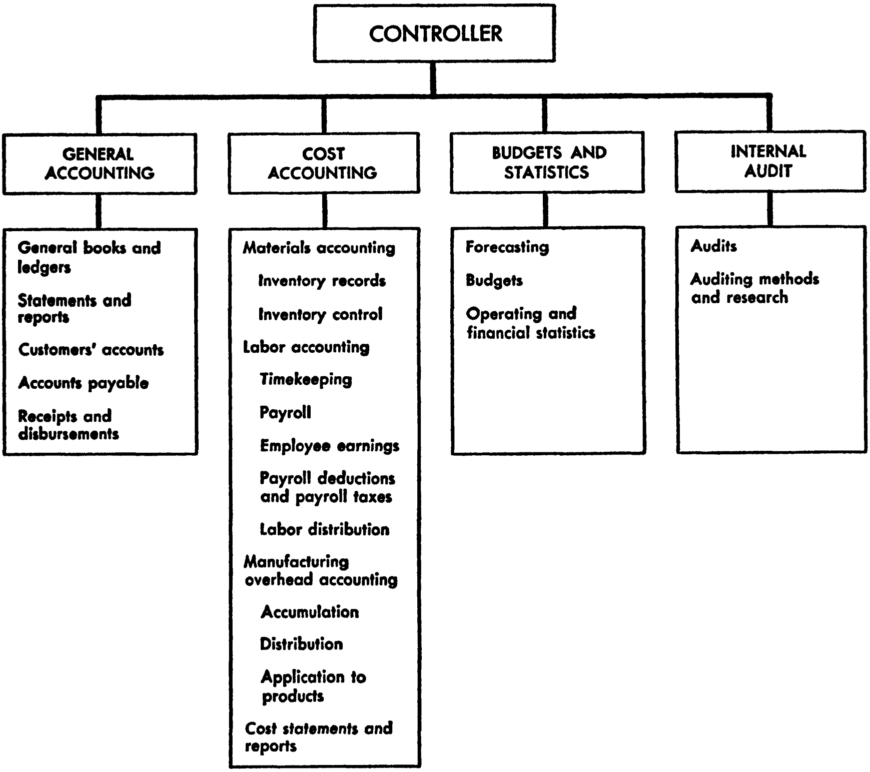


FIGURE 2. Organization of Controller's Department

Recording information on the proper forms, classifying and summarizing the figures, and filing of records are the first task of the cost accountant. This comprises the usual bookkeping and clerical work which is done in a cost accounting department. The work requires accuracy and often a considerable amount of skill handling records and using office machines. However, the tasks are largely repetitive and can be performed by clerks.

Next in importance is the analysis, reporting, and interpreting of costs. The cost accountant does not manage the business, but he does supply information (both facts and expert opinions) which enables management to direct the activities of the business more successfully. The cost accountant cooperates with other divisions of the company to learn what their problems are and how he can be of assistance in helping them reach their goals successfully. In this way, cost accounting is an important technique which has materially aided business management to organize productive resources to yield more goods and services and higher standards of living. This aspect of the cost accountant's work calls for an extensive knowledge of cost accounting, a broad acquaintance with business methods, and in addition a great deal of skill in presenting information to others in both written and spoken form. It is the chief cost accountant who most commonly does this type of work.

Finally the cost accountant is responsible for operating his own department. This includes design of the accounting system, i.e., deciding what records shall be kept, how the information is to be assembled and classified, and how the office routines are to be performed economically. Cost accounting is a practical subject which must be justified on the ground that information about costs is worth at least as much is it costs to obtain it.

Budgeting. This function has been defined as translating the plans for the business into terms of money, and then consulting with the executives in the shaping and modification of those plans so that the objective of the business, earning a profit, may be attained.

The budgeting personnel has the responsibility of continuous comparison of actual results with the budgets and the preparation of analyses and reports to explain the discrepancies. If results are more favorable than anticipated, the causes should be determined to take definite advantage of them and to make repetition possible; if results are unfavorable, the causes are sought for determining means of corrective action. Most of the data for these comparisons originate in the cost department and many of the causes for the variances can be identified. While the cost department can await requests for such analyses of causes of variances, it should take the initiative in reporting them.

Internal Auditing. The task of checking the accuracy of the records is a function of the controller. This work of internal audit and scrutiny is made easier if a proper system of *internal check* has been developed. The latter refers to the system which prescribes the methods by which the integrity of the records is safeguarded. This is usually done by a system of checks and balances so that the work is subdivided among employees, the work of each complementing that of the others. The term "internal audit" refers to the more or less continuous auditing procedures intended to implement the system of internal check. In other words, the internal auditor checks the degree of compliance with instructions as laid down in the internal check system.

QUESTIONS

1. The president of a manufacturing company called the chief cost accountant and asked him for the cost of one of the company's products. Before giving a figure, the cost accountant inquired as to the purpose for which the cost was wanted. In reply, the president said, "Never mind what I want to use it for. Just tell me *the cost.*"

   Explain why the cost accountant needs to know the purpose for which the cost figure is to be used.

2. To what extent do you agree with the following statements? Point out any part with which you disagree and explain why.

   a) "Cost accounting is that part of general accounting which specializes in operating expenditures and the translating of these expenditure figures into the cost of specific units of service or products."
   b) "One company spends over a million dollars a year for accounting. The justification for such a large expenditure lies in provision of information which management can use to increase profits."
   c) "The cost accountant's work is to accumulate, classify, summarize, and prepare reports on costs."
   d) "The cost accountant is not concerned with the operations of the factory or sales department; his duty is simply to record the costs as they are incurred."
   e) "Prices to consumers could be lower if business men did not spend so much for overhead items such as accounting."
   f) "I suppose cost accounting is necessary for financial reports and tax returns, but it doesn't help run the business."

3. Scientific management is directly connected with the great industrial growth of the United States. How does cost accounting supplement the contribution of scientific management?

4. Is there a necessary conflict between the field covered by financial accounting and the area generally allocated to cost accounting? Explain.

5. It has been maintained by some that cost accounting is a purely mechanical operation concerned with cost determination and as such is merely glorified bookkeeping. Do you agree? Explain.

6. There is no one cost to manufacture an item; rather, the cost depends on the purpose to be served. List five different purposes for which costs are determined.

7. In the development of costs for different purposes, does the accountant keep a separate set of records for each different kind of cost? Explain.

8. Explain by illustration five areas other than manufacturing where cost accounting techniques have been applied.
9. Does the financial accountant classify expenses on a functional basis? Explain by comparison with functional classification as practiced by the cost accountant.
10. Long before the development of cost accounting, financial accountants prepared profit and loss statements for companies engaged in manufacturing. They continue to do so. How does the cost accountant aid in the determination of profit or loss?
11. *a*) The manufacturing process has been called a process of capitalizing expenditures. Explain.
    b) Is the selling process similarly a process of capitalization? Explain.
12. List three business situations depending in a significant way upon cost computation for their solution.
13. One of the contributions of the cost accountant has been the development of cost information for management at the shop-foreman level. What kind of cost information should a foreman be furnished?
14. List some areas of government activity to which cost accounting techniques can be or are being applied.

Chapter 2

FINANCIAL ACCOUNTING FOR A MANUFACTURING BUSINESS

Financial Statements of a Manufacturing Business. The statements of a manufacturing concern have certain distinguishing features which reflect the manufacturing activities of the company. Otherwise, they do not differ materially from the financial statements of a trading company. The items of difference are:

1. In the balance sheet
    - *a*) Inventories reflecting the costs of manufacturing goods which have not yet been sold
    - *b*) Fixed assets representing the facilities used in manufacturing
2. In the income statement
    - *a*) Cost of goods sold representing the costs of making goods which have been manufactured and sold. The details of manufacturing cost are usually shown in a supporting schedule rather than in the income statement.

The principal financial statements of a manufacturing company are discussed and illustrated in the succeeding pages of this chaper. However, only those items on the statements which are the special concern of the cost accountant are covered.

Inventories of a Manufacturing Company. The inventories of a manufacturing company are usually found in varying stages of completion. Hence they are classified on the balance sheet as raw materials, work in process, finished parts, and finished goods.

The raw materials inventory is made up of materials which have not yet been used. They are ordinarily found in a storeroom or other place where they can be protected and identified. They are not necessarily "raw" in the sense that they are commodities not previously processed, for the finished product of one industry becomes the raw material of another. Thus steel is the finished product of the steel mill but a raw material from which automobiles are made; and flour is the product of a flour mill but a raw material of the baker.

Manufacturing supplies are sometimes included with raw materials, sometimes shown separately on the balance sheet. They are items used in operating the factory; for example, lubricating oil and grease, floor sweeping compound, rags for wiping machines and stationery and other supplies used in the factory.

Work in process is composed of goods in varying stages of completion. It is found in producing departments or in temporary storage awaiting further processing. In the ledger it is customary to keep three accounts for work in process inventory. One of these accounts records the cost of materials, one the cost of labor, and one manufacturing overhead. The balances of these accounts are usually combined into a single item representing the total value of work in process for balance sheet presentation.

Finished parts represent components entering into finished goods through one or more assembly operations. Thus finished parts may be purchased and then assembled into a finished product or they may be manufactured from raw materials in one department or division of a plant, placed in a finished parts storeroom, and then reissued for assembly into a finished product. Actually, finished parts serve a double purpose. They may be sold to customers as repair and replacement parts or used in assembling the finished product.

Finished goods are the completed products ready for shipment or sale to the company's customers. They are ordinarily found in a warehouse where they are stored awaiting shipment in those cases where the plant is manufacturing goods for stock. Where goods are made to a customer's order and specifications, the finished goods most likely move from the factory directly to the shipping room floor. On the balance sheet the finished goods inventory often includes the finished parts inventory.

While the above divisions of the inventory of a manufacturing business are typical, there are exceptions. Thus there are some businesses (a milk pasteurizing plant, for example) which, by reason of the perishable nature of the product, cannot store either raw material or finished product for more than a few hours. These companies have little in the way of inventories at the close of a period. Other companies have a very short processing period and finish all work started each day so there is no work in process inventory on the balance sheet. Still other companies move completed products directly from the assembly line to freight cars and thus keep no inventories of finished product.

Fixed Assets of a Manufacturing Company. Among the fixed assets of a manufacturing company are found the machinery and equipment used in manufacturing. Thus a metal working plant has furnaces, punch presses, lathes, milling machines, grinders, and other machines together with conveyors, elevators, trucks, and similar equipment for moving materials. In addition, there are buildings and land since these are usually owned by the company. It is also common to find patents listed on the balance sheet of a manufacturing company, for these are often very valuable assets in manufacturing.

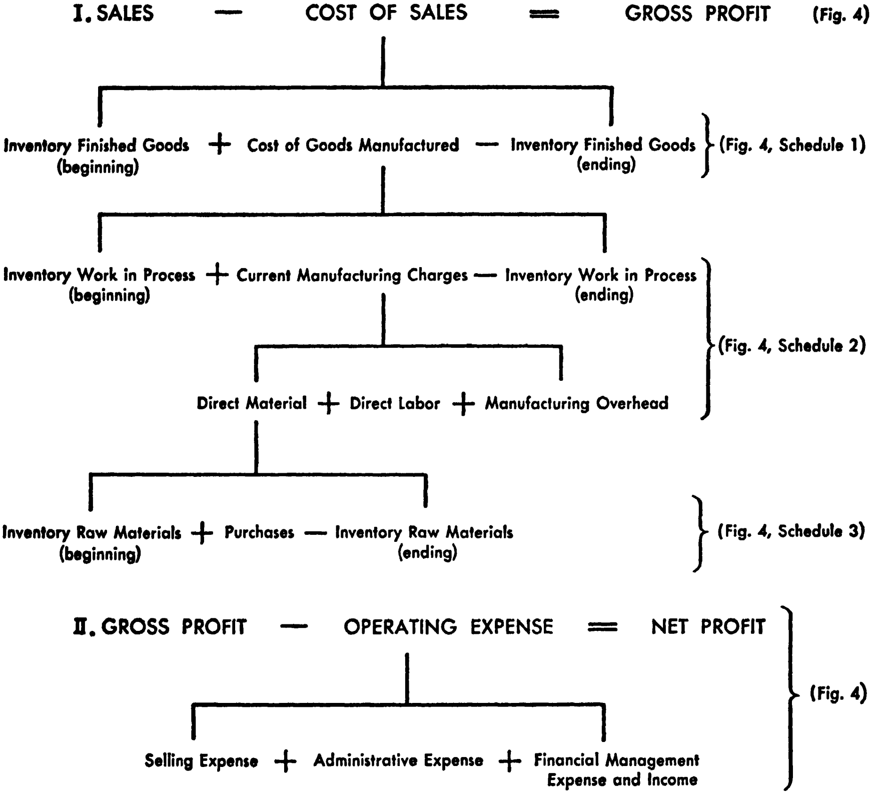

I. SALES — COST OF SALES = GROSS PROFIT (Fig. 4)
Inventory Finished Goods (beginning) + Cost of Goods Manufactured — Inventory Finished Goods (ending)
(Fig. 4, Schedule 1)
Inventory Work in Process (beginning) + Current Manufacturing Charges — Inventory Work in Process (ending)
Direct Material + Direct Labor + Manufacturing Overhead
(Fig. 4, Schedule 2)
Inventory Raw Materials (beginning) + Purchases — Inventory Raw Materials (ending)
(Fig. 4, Schedule 3)
II. GROSS PROFIT — OPERATING EXPENSE = NET PROFIT
Selling Expense + Administrative Expense + Financial Management Expense and Income
(Fig. 4)

FIGURE 3. Composition of Profit and Loss Statement

The tangible fixed assets constitute the tools employed in making products. They are durable, but nevertheless they depreciate and eventually must be replaced with new equipment. Depreciation thus constitutes a cost of the goods which are made with the use of the buildings, machines, and tools. The ownership of these assets also brings recurring expenditures for property taxes and insurance and their use makes it necessary to spend money for maintenance, repairs, and power. These are also costs of producing the goods made with the equipment.

Profit and Loss Statement. The profit and loss or income statement of a manufacturing company contains two principal types of items in the form of (1) revenue from sales and (2) costs and expenses incurred in earning the revenues. The composition of the profit and loss statement, i.e., the way in which the different sections making up the statement are related, is shown in diagrammatic form in Figure 3. The application of the formulas contained in the diagram is then shown for a specific case in Figure 4 and the related schedules.

The general outline illustrated in these figures is of course subject to many modifications. For example, it may well happen that in a given plant all the work started at the beginning of the day is completed on the same day and hence there would be no work in process to be considered. A dairy or a bakery is a good illustration in point. In such a case the current manufacturing charges become identical with manufacturing cost. Again there are plants, particularly those manufacturing only to customers' orders, where the finished product moves directly from the factory to the shipping room, instead of to the finished stockroom. In such cases, there are no finished goods inventories and the cost of production is identical with the cost of sales. Where neither work in process nor finished goods exist at closing time (a bakery again), the current manufacturing charges (material, labor, overhead) constitute the cost of sales.

Financial Accounts of a Manufacturing Business. The day-by-day accounting is concerned largely with recording transactions with creditors and customers. Materials, supplies, and services are purchased from creditors on account or for cash; wages and salaries of employees are paid; and various other expenses such as taxes are paid. Sales of the product manufactured are recorded in customers' accounts receivable, and cash collections from these customers are credited to accounts receivable and debited to cash.

At the end of the accounting period, a number of adjusting entries must be made before closing and preparing the financial statements. These adjustments include the recording of:

1. Inventories of raw materials, factory and other supplies, work in process, finished parts, and finished goods
2. Any previously unrecorded liabilities for accrued wages, property taxes, and other unrecorded but accrued liabilities
3. The expiration of prepaid insurance and any other prepaid expenses
4. Depreciation of plant and equipment and customer account adjustments

THE PASCAL MANUFACTURING COMPANY, INC.
PROFIT AND LOSS STATEMENT

For the Month Ended January 31, 19—

Sales		$90,000.00
Cost of Sales (Schedule 1)		57,000.00
Gross Profit		$33,000.00
Operating Expenses		
Selling Expenses	$16,000.00	
Administrative Expenses	9,000.00	
Financial Management Expenses	1,000.00	26,000.00
Net Profit		$ 7,000.00

Figure 4. Condensed Profit and Loss Statement

Schedule 1

COST OF SALES

Finished Goods Inventory, January 1	$13,000.00
Cost of Goods Manufactured (Schedule 2)	66,000.00
Total Finished Goods Available for Sale	$79,000.00
Less: Finished Goods Inventory, January 31	22,000.00
Cost of Sales	$57,000.00

Schedule 2

COST OF GOODS MANUFACTURED

Inventory Work in Process, January 1			$18,000.00
Direct Material (Schedule 3)		$20,000.00	
Direct Labor		41,000.00	
Manufacturing Overhead			
Indirect Labor	$2,900.00		
Power	500.00		
Light	100.00		
Repairs	500.00		
General Factory Overhead	100.00		
Depreciation	500.00		
Insurance	300.00		
Stationery and Printing	100.00		
Rent	2,000.00	7,000.00	
Current Manufacturing Charges			68,000.00
Total Work in Process Handled			$86,000.00
Less: Inventory Work in Process, January 31			20,000.00
Cost of Goods Manufactured			$66,000.00

Schedule 3

DIRECT MATERIAL COST

Inventory Raw Material, January 1	$10,000.00
Purchases	18,000.00
Total Raw Material Handled	$28,000.00
Less: Inventory Raw Material, January 31	8,000.00
Direct Material Cost	$20,000.00

When the necessary adjusting entries have been completed, the expense and revenue accounts are closed into the Profit and Loss account in the usual manner. If desired, it is possible to set up a separate manufacturing account. This particular method is illustrated in the demonstration problem at the end of the chapter. A simpler method consists of recording, by means of adjusting entries, all inventories, accruals, and prepayments. The balances in the old inventories and in all nominal accounts may then be closed to Profit and Loss.

Determining Inventories. It is necessary to know the cost of goods in the closing inventories before the profit or loss for the period can be determined. Under the procedure illustrated above, a physical count of materials, work in process, and finished goods must be made at the end of the period in order to ascertain what quantities of goods are on hand. The quantity of each item in the inventory is then multiplied by its unit cost and the resulting products summed to obtain total cost of goods in inventory. Unit costs for the raw materials can usually be obtained from vendors' invoices. Unit costs of finished and partly finished goods must be computed from the costs of material, labor, and overhead used in manufacturing.

For the latter purpose two methods are available:

1. Estimate the unit cost from specifications of the product and a knowledge of manufacturing methods used.
2. Keep detailed records of the actual costs of manufacturing.

Financial Accounting Problem Illustration

Statement of Problem. In order to review in detail the financial accounting procedure, the following problem is stated and solved. The special journals are dispensed with for convenience. All entries are made in one journal. They include current, adjusting, and closing entries. Illustrations of the general ledger accounts appearing in a trial balance, before inclusion of the final inventories and of the financial statements, are presented. In order to reduce the number of detailed accounts, all expenses are summarized under three group accounts: (1) Manufacturing Overhead, (2) Selling Expense, (3) Administrative Expense. The details, based upon information contained in the statement of the problem, are summarized in a special schedule to be used in preparing the detailed profit and loss statement.

1. The opening trial balance of the Sullivan Manufacturing Corporation, January 1, 19—, appears as follows:

Imprest Cash Fund	$ 500.00	
Cash	20,000.00	
Accounts Receivable	10,000.00	
Notes Receivable	5,000.00	
Stores	9,000.00	
Supplies	1,000.00	
Work in Process	15,000.00	
Finished Goods	12,000.00	
Machinery and Equipment	57,600.00	
Furniture and Fixtures	3,600.00	
Prepaid Insurance	1,500.00	
Vouchers Payable		$ 12,000.00
Notes Payable		2,000.00
Allowance for Depreciation of Machinery and Equipment		5,760.00
Allowance for Depreciation of Furniture and Fixtures		540.00
Capital Stock		100,000.00
Retained Earnings		14,900.00
	$135,200.00	$135,200 00

2. The summary of the voucher register, including apportionments to the major divisions for the month of January, was as follows:

Purchases of raw materials		$18,000.00
Purchases of supplies		2,000.00
Direct labor		39.000.00
Indirect labor		1,800.00
Notes payable		1,000.00
Rent, to be apportioned as follows:		
Manufacturing	$1,700.00	
Selling	150.00	
Administrative	150.00	2,000.00
Power		500.00
Light, to be apportioned as follows:		
Manufacturing	$105.00	
Selling	9.00	
Administrative	11.00	125.00
Office supplies, to be apportioned as follows:		
Manufacturing	$50.00	
Selling	25.00	
Administrative	25.00	100.00
Repairs to machinery		500.00
General manufacturing overhead		110.00
Salesmen's salaries		1,500.00
Office salaries		2,000.00
Total vouchers payable		$68,635.00

3. The summaries of the sales journal and sales returns and allowance journal for the month were as follows:

Sales	$62,000.00
Sales Allowances	300.00
Sales Returns	250.00

4. The cash receipts for the month were as follows:

Net Cash	$61,800.00
Cash Discount on Sales	1,200.00
Accounts Receivable	60,000.00
Notes Receivable	3,000.00

5. The cash disbursements during the month were as follows:

Net Cash	$59,000.00
Cash Discount on Purchases	1,000.00

6. There were given notes in the amount of $3,000 in payment of vouchers payable; $2,000 of notes were received in payment of open accounts during the month.

7. Depreciation on machinery and equipment amounts to $480 for the month, and depreciation on furniture and fixtures $45, of which $15 is to be charged to selling expense and $30 to administrative expense.

8. Insurance expired for the month amounted to $537 which was charged as follows:

Manufacturing Overhead	$513.00
Selling Expense	20.00
Administrative Expense	4.00

9. Wages accrued amounted to $3,400 and were charged as follows:

Direct Labor	$2,500.00
Indirect Labor	900.00

10. A provision for bad debts was made in the amount of $310.

11. The physical inventories were as follows:

Raw Materials	$ 6,200.00
Supplies	1,800.00
Work in Process	20,483.00
Finished Goods	21,200.00

Requirements:

1. Current, adjusting, and closing entries
2. Ledger accounts
3. Trial balance and work sheet
4. Cost of sales schedule
5. Profit and loss statement
6. Balance sheet

JOURNAL ENTRIES

January 31, 19—

Purchases of Stores		$18,000.00	
Supplies		2,000.00	
Direct Labor		39,000.00	
Manufacturing Overhead		4,765.00	
Indirect Labor	$1,800.00		
Rent	1,700.00		
Power	500.00		
Light	105.00		
Office Supplies	50.00		
Repairs to Machinery	500.00		
General Manufacturing Overhead	110.00		
Notes Payable		1,000.00	
Selling Expense		1,684.00	
Sales Salaries	$1,500.00		
Rent	150.00		
Light	9.00		
Office Supplies	25.00		
Administrative Expenses		2,186.00	
Office Salaries	$2,000.00		
Rent	150.00		
Light	11.00		
Office Supplies	25.00		
Vouchers Payable			$68,635.00

To record summary of Voucher Register for the month of January, 19—.

- 31 -

Accounts Receivable	$62,000.00	
Sales		$62,000.00

To record sales for January as per summary of Sales Journal.

- 31 -

Sales Allowances	$ 300.00	
Sales Returns	250.00	
Accounts Receivable		$ 550.00

To record sales returns and allowances as per summary of Sales Returns and Allowances Journal.

- 31 -

Cash	$61,800.00	
Cash Discount on Sales	1,200.00	
Accounts Receivable		$60,000.00
Notes Receivable		3,000.00

- 31 -

Vouchers Payable	$60,000.00	
Cash Discount on Purchases		$ 1,000.00
Cash		59,000.00

To record summary of Cash Receipts and Cash Disbursements Journal for January, 19—.

- 31 -

Vouchers Payable	$ 3,000.00	
Notes Payable		$ 3,000.00

To record issuance of notes in payment of vouchers.

- 31 -

Notes Receivable	$ 2,000.00	
Accounts Receivable		$ 2,000.00

To record notes received from customers.

(*Note:* At this point a trial balance is taken; see work sheet.)

ADJUSTING ENTRIES

January 31, 19—

(1)

Manufacturing Overhead (Depreciation)	$ 480.00	
Selling Expense (Depreciation)	15.00	
Administrative Expense (Depreciation)	30.00	
Allowance for Depreciation of Machinery and Equipment		$ 480.00
Allowance for Depreciation of Furniture and Fixtures		45.00

To charge for depreciation for month of January, 19—.

(2)

Manufacturing Overhead (Insurance)	$ 513.00	
Selling Expense (Insurance)	20.00	
Administrative Expense (Insurance)	4.00	
Prepaid Insurance		$ 537.00

To charge insurance expired for January, 19—.

(3)

Direct Labor	$ 2,500.00	
Manufacturing Overhead (Indirect Labor)	900.00	
Accrued Wages		$ 3,400.00

To charge amount of wages accrued to January 31, 19—.

(4)

Administrative Expense (Bad Debts)	$ 310.00	
Allowance for Bad Debts		$ 310.00

To charge operations for estimated bad debts for January 19—.

(5)

Stores (New)	$ 6,200.00	
Work in Process (New)	20,483.00	
Cost of Goods Manufactured		$26,683.00

To record inventories on hand January 31, 19—.

(6)

Finished Goods (New)	$21,200.00	
Cost of Sales		$21,200.00

To record inventory on hand January 31, 19—.

(7)

Supplies (New)	$ 1,800.00	
Supplies (Old)		$ 1,800.00

To record prepaid expense, supplies on hand January 31, 19—.

(8)

Manufacturing Overhead (Supplies)	$ 1,200.00	
Supplies (Old)		$ 1,200.00

To record cost of supplies consumed in January, 19—.

(9)

Cost of Goods Manufactured	$76,358.00	
Stores (Old)		$ 9,000.00
Purchases of Stores		18,000.00
Direct Labor		41,500.00
Manufacturing Overhead		7,858.00

To close charges for goods produced in January 19—.

(10)

Cost of Goods Manufactured	$15,000.00	
Work in Process (Old)		$15,000.00

To close January 1 inventory of goods in process.

(11)

Cost of Sales	$64,675.00	
Cost of Goods Manufactured		$64,675.00

To close the latter account.

(12)

Cost of Sales	$12,000.00	
Finished Goods (Old)		$12,000.00

To close the January 1 inventory of finished goods.

CLOSING ENTRIES

January 31, 19—

Profit and Loss	$61,474.00	
Cost of Sales		$55,475.00
Selling Expenses		1,719.00
Administrative Expenses		2,530.00
Cash Discount on Sales		1,200 00
Sales Returns		250.00
Sales Allowances		300.00

To close costs and expenses for January, 19- -.

- 31 -

Sales	$62,000.00	
Cash Discount on Purchases	1,000.00	
Profit and Loss		$63,000.00

To close all revenue accounts for January.

- 31 -

Profit and Loss	$ 1,526.00	
Retained Earnings		$ 1,526.00

To close net profit for January.

LEDGER ACCOUNTS

IMPREST CASH FUND

1/1	Balance	$ 500.00	1/31	Balance	$ 500.00
2/1	Balance	$ 500.00			

CASH IN BANK

1/1	Balance	$ 20,000.00	1/31	Disbursements	$ 59,000.00
1/31	Receipts	61,800.00	1/31	Balance	22,800.00
		$ 81,800.00			$ 81,800.00
2/1	Balance	$ 22,800.00			

ACCOUNTS RECEIVABLE

1/1	Balance	$ 10,000.00	1/31	Sales Returns and Allowances	$ 550.00
1/31	Sales	62,000.00	1/31	Cash	60,000.00
			1/31	Notes Receivable	2,000.00
			1/31	Balance	9,450.00
		$ 72,000.00			$ 72,000.00
2/1	Balance	$ 9,450.00			

NOTES RECEIVABLE

1/1	Balance	$ 5,000.00	1/31	Cash	$ 3,000.00
1/31	Accounts Receivable	2,000.00	1/31	Balance	4,000.00
		$ 7,000.00			$ 7,000.00
2/1	Balance	$ 4,000.00			

STORES

1/1	Balance	$ 9,000.00	1/31	Cost of Goods Manufactured	$ 9,000.00
2/1	Inventory	$ 6,200.00			

SUPPLIES

1/1	Balance	$ 1,000.00	1/31	Inventory	$ 1,800.00
1/31	Purchases	2,000.00	1/31	Manufacturing Overhead	1,200.00
		$ 3,000.00			$ 3,000.00
2/1	Inventory	$ 1,800.00			

WORK IN PROCESS

1/1	Balance	$ 15,000.00	1/31	Cost of Goods Manufactured	$ 15,000.00
2/1	Inventory	$ 20,483.00			

FINISHED GOODS

1/1	Balance	$ 12,000.00	1/31	Cost of Sales	$ 12,000.00
2/1	Inventory	$ 21,200.00			

MACHINERY AND EQUIPMENT

1/1	Balance	$ 57,600.00	1/31	Balance	$ 57,600.00
2/1	Balance	$ 57,600.00			

FURNITURE AND FIXTURES

1/1	Balance	$ 3,600.00	1/31	Balance	$ 3,600.00
2/1	Balance	$ 3,600.00			

PREPAID INSURANCE

1/1	Balance	$ 1,500.00	1/31	Expired	$ 537.00
			1/31	Balance	963.00
		$ 1,500.00			$ 1,500.00
2/1	Balance	$ 963.00			

VOUCHERS PAYABLE

1/31	Cash	$ 60,000.00	1/1	Balance	$ 12,000.00
1/31	Notes Payable	3,000.00	1/31	January Vouchers	68,635.00
1/31	Balance	17,635.00			
		$ 80,635.00			$ 80,635.00
			2/1	Balance	$ 17,635.00

NOTES PAYABLE

1/31	Cash	$ 1,000.00	1/1	Balance	$ 2,000.00
1/31	Balance	4,000.00	1/1	Vouchers Payable	3,000.00
		$ 5,000.00			$ 5,000.00
			2/1	Balance	$ 4,000.00

WAGES ACCRUED

1/31	Balance	$ 3,400.00	1/31	January accrual	$ 3,400.00
			2/1	Balance	$ 3,400.00

ALLOWANCE FOR DEPRECIATION OF MACHINERY AND EQUIPMENT

1/31	Balance	$ 6,240.00	1/1	Balance	$ 5,760.00
			1/31	Provision—January	480.00
		$ 6,240.00			$ 6,240.00
			2/1	Balance	$ 6,240.00

ALLOWANCE FOR DEPRECIATION OF FURNITURE AND FIXTURES

1/31	Balance	$ 585.00	1/1	Balance	$ 540.00
			1/31	Provision—January	45.00
		$ 585.00			$ 585.00
			2/1	Balance	$ 585.00

ALLOWANCE FOR BAD DEBTS

1/31	Balance	$ 310.00	1/31	Provision—January	$ 310.00
			2/1	Balance	$ 310.00

CAPITAL STOCK

1/31	Balance	$100,000.00	1/1	Balance	$100,000.00
			2/1	Balance	$100,000.00

RETAINED EARNINGS

1/31	Balance	$ 16,426.00	1/1	Balance	$ 14,900.00
			1/31	Profit—January	1,526.00
		$ 16,426.00			$ 16,426.00
			2/1	Balance	$ 16,426.00

PROFIT AND LOSS

1/31	Cost of Sales	$ 55,475.00	1/31	Sales	$ 63,000.00
	Selling Expense	1,719.00			
	Administrative Expense	2,530.00			
	Cash Discount on Sales	1,200.00			
	Sales Returns	250.00			
	Sales Allowances	300.00			
	Retained Earnings	1,526.00			
		$ 63,000.00			$ 63,000.00

COST OF SALES

1/31	Cost of Goods Manufactured	$ 64,675.00	1/31	Finished Goods	$ 21,200.00
	Finished Goods	12,000.00	1/31	Profit and Loss	55,475.00
		$ 76,675.00			$ 76,675.00

SALES

1/31	Profit and Loss	$ 62,000.00	1/31	Total January	$ 62,000.00

SALES RETURNS

1/31		$ 250.00	1/31	Profit and Loss	$ 250.00

SALES ALLOWANCES

1/31		$ 300.00	1/31	Profit and Loss	$ 300.00

PURCHASES OF STORES

1/31	Vouchers Payable	$ 18,000.00	1/31	Cost of Goods Manufactured	$ 18,000.00

DIRECT LABOR

1/31	Vouchers Payable	$ 39,000.00	1/31	Cost of Goods Manufactured	$ 41,500.00
1/31	Accrued Wages	2,500.00			
		$ 41,500.00			$ 41,500.00

MANUFACTURING OVERHEAD

1/31	Vouchers Payable	$ 4,765.00	1/31	Cost of Goods Manufactured	$ 7,858.00
1/31	Depreciation	480.00			
1/31	Insurance	513.00			
1/31	Accrued Wages	900.00			
1/31	Supplies	1,200.00			
		$ 7,858.00			$ 7,858.00

SELLING EXPENSE

1/31	Vouchers Payable	$ 1,684.00	1/31	Profit and Loss	$ 1,719.00
1/31	Depreciation	15.00			
1/31	Insurance	20.00			
		$ 1,719.00			$ 1,719.00

ADMINISTRATIVE EXPENSE

1/31	Vouchers Payable	$ 2,186.00	1/31	Profit and Loss	$ 2,530.00
1/31	Depreciation	30 00			
1/31	Insurance	4.00			
1/31	Bad Debts	310.00			
		$ 2,530.00			$ 2,530.00

CASH DISCOUNT ON SALES

1/31		$ 1,200.00	1/31	Profit and Loss	$ 1,200.00

CASH DISCOUNT ON PURCHASES

1/31	Profit and Loss	$ 1,000.00	1/31		$ 1,000.00

COST OF GOODS MANUFACTURED

1/31	Stores	$ 9,000.00	1/31	Inventory (New)	$ 26,683.00
1/31	Purchases	18,000.00	1/31	Cost of Sales	64,675.00
1/31	Direct Labor	41,500.00			
1/31	Manufacturing Overhead	7,858.00			
1/31	Goods in Process	15,000.00			
		$ 91,358.00			$ 91,358.00

SULLIVAN MANUFACTURING CORPORATION WORK SHEET, JANUARY 31, 19—

Account	Preclosing Trial Balance		Adjustments		Profit and Loss		Balance Sheet	
	Dr	Cr	Dr	Cr	Dr	Cr	Dr.	Cr.
Imprest Cash	$ 500 00						$ 500 00	
Cash in Bank	22,800 00						22,800 00	
Accounts Receivable	9,450 00						9,450.00	
Notes Receivable	4,000 00						4,000 00	
Stores	9,000 00			(9)$ 9,000 00				
Supplies	3,000 00			(7) 1,800 00				
				(8) 1,200 00				
Work in Process	15,000 00			(10) 15,000 00				
Finished Goods	12,000 00			(12) 12,000 00				
Machinery and Equipment	57,600 00						57,600 00	
Furniture and Fixtures	3,600 00						3,600 00	
Prepaid Insurance	1,500 00			(2) 537 00			963 00	
Vouchers Payable		$ 17,635 00						$ 17,635 00
Notes Payable		4,000 00						4,000.00
Allowance for Depreciation—Machinery and Equipment		5,760 00		(1) 480 00				6,240 00
Allowance for Depreciation—Furniture and Fixtures		540 00		(1) 45.00				585 00
Capital Stock		100,000 00						100,000.00
Retained Earnings		14,900 00						14,900 00
Sales		62,000.00				$62,000 00		
Sales Returns	250 00				$ 250.00			
Sales Allowances	300.00				300.00			
Purchases of Stores	18,000 00			(9) 18,000 00				
Direct Labor	39,000 00		(3)$ 2,500 00	(9) 41,500 00				
Manufacturing Overhead	4,765 00		(1) 480.00	(9) 7,858 00				
			(2) 513 00					
			(3) 900 00					
			(8) 1,200 00					
Administrative Expense	2,186 00		(1) 30 00					
			(2) 4 00					
			(4) 310 00		2,530 00			
Cash Discount on Sales	1,200 00				1,200 00			
Cash Discount on Purchases		1,000.00				1,000.00		
Selling Expense	1,684 00		(1) 15 00					
			(2) 20 00		1,719 00			
	$205,835 00	$205,835 00						
New Accounts								
Wages Accrued				(3) 3,400 00				3,400 00
Allowance for Bad Debts				(4) 310.00				310.00
Stores (New)			(5) 6,200 00				6,200 00	
Work in Process (New)			(5) 20,483.00				20,483.00	
Cost of Goods Manufactured			(9) 76,358.00 (10) 15,000 00	(5) 26,683 00 (11) 64,675 00				
Finished Goods (New)			(6) 21,200 00				21,200.00	
Cost of Sales			(11) 64,675 00	(6) 21,200.00				
			(12) 12,000.00		55,475 00			
Supplies			(7) 1,800.00				1,800 00	
			$223,688 00	$223,688 00	$61,474.00	$63,000.00	$148,596.00	$147,070 00
Profit for January					1,526 00			1,526 00
					$63,000 00	$63,000 00	$148,596 00	$148,596 00

Exhibit A

SULLIVAN MANUFACTURING CORPORATION

BALANCE SHEET, JANUARY 31, 19—

ASSETS

Current Assets			
Imprest Cash		$ 500.00	
Cash in Bank		22,800.00	
Accounts Receivable	$ 9,450.00		
Less: Allowance for Bad Debts	310.00	9,140.00	
Notes Receivable		4,000.00	
Raw Materials and Supplies		8,000.00	
Work in Process		20,483.00	
Finished Goods		21,200.00	
Prepaid Insurance		963.00	
Total Current Assets			$ 87,086.00
Fixed Assets			
Machinery and Equipment	$57,600.00		
Less: Allowance for Depreciation	6,240.00	$51,360.00	
Furniture and Fixtures	$ 3,600.00		
Less: Allowance for Depreciation	585.00	3,015.00	
Total Fixed Assets			54,375.00
Total Assets			$141,461.00

LIABILITIES AND NET WORTH

Current Liabilities			
Vouchers Payable		$ 17,635.00	
Notes Payable		4,000.00	
Wages Accrued		3,400.00	
Total Current Liabilities			$ 25,035.00
Net Worth			
Capital Stock Authorized, Issued and Outstanding		$100,000.00	
Retained Earnings, January 1, 19—	$14,900.00		
Profit for January	1,526.00	16,426.00	
Total Net Worth			116,426.00
Total Liabilities and Net Worth			$141,461.00

Exhibit B

SULLIVAN MANUFACTURING CORPORATION

PROFIT AND LOSS STATEMENT

For the Month Ending January 31, 19—

Sales		$62,000.00
Less: Sales Returns	$ 250.00	
Sales Allowances	300.00	550.00
Income from Sales		$61,450.00
Cost of Sales (Schedule 1)		55,475.00
Gross Profit on Sales		$ 5,975.00
Operating Expenses:		
Selling Expenses (Schedule 3)	$1,719.00	
Administrative Expenses (Schedule 3)	2,530.00	
Financial Management Expense (Schedule 3)	200.00	
Total Operating Expenses		4,449.00
Net Profit from Operations		$ 1,526.00

Exhibit B
Schedule 1

SULLIVAN MANUFACTURING CORPORATION

COST OF SALES

For the Month Ending January 31, 19—

Inventory Finished Goods, January 1, 19—	$12,000.00
Cost of Production (Schedule 2)	64,675.00
Total Finished Goods Available for Sale	$76,675.00
Less: Inventory Finished Goods, January 31, 19—	21,200.00
Cost of Sales	$55,475.00

Exhibit B
Schedule 2

SULLIVAN MANUFACTURING CORPORATION

COST OF PRODUCTION

For the Month of January, 19—

Material and Supplies Consumed:		
Inventory Stores, January 1, 19—	$ 9,000.00	
Purchases of Stores	18,000.00	
Total Material Handled	$27,000.00	
Less: Inventory Stores, January 31, 19—	6,200.00	
Material Consumed		$20,800.00
Direct Labor		41,500.00
Manufacturing Overhead (Schedule 3)		7,858.00
Manufacturing Charges for the Period		$70,158.00
Inventory Work in Process, January 1, 19—		15,000.00
Total Work in Process Handled		$85,158.00
Less: Inventory Work in Process, January 31, 19—		20,483.00
Cost of Production		$64,675.00

Exhibit B
Schedule 3

SULLIVAN MANUFACTURING CORPORATION
ANALYSIS OF OVERHEAD
For the Month of January, 19—

	Manufacturing	Selling	Administrative	Financial Management	Total
Indirect Labor	$2,700.00				$ 2,700.00
Factory Supplies	1,200.00				1,200.00
Rent	1,700.00	$ 150.00	$ 150.00		2,000.00
Power	500.00				500.00
Light	105.00	9.00	11.00		125.00
Office Supplies	50.00	25.00	25.00		100.00
Repairs to Machinery	500.00				500.00
General Expenses	110.00				110.00
Salaries		1,500.00	2,000.00		3,500.00
Depreciation	480.00	15.00	30.00		525.00
Insurance	513.00	20.00	4.00		537.00
Bad Debts Expense			310.00		310.00
Cash Discount on Sales				$1,200.00	1,200.00
Cash Discount on Purchases				1,000 00 *	1,000.00 *
	$7,858.00	$1,719.00	$2,530.00	$ 200.00	$12,307.00

* Red

QUESTIONS

1. As a financial accountant, list the items in a trial balance peculiar to a manufacturing enterprise as against a business engaged in trading.
2. List the different inventories one may find in a statement of production cost. How does the accountant verify the accuracy of these inventory values?
3. It has been noted that steps in determining cost of raw materials consumed, cost of supplies consumed, and cost of goods manufactured are identical with the procedure used in ascertaining the cost of goods sold. Explain by use of "T" accounts.
4. Is the cost of goods manufactured equivalent to purchases in a trading company? Explain.
5. List the steps in closing the books of a company engaged in manufacturing.
6. Beyond the trial balance, what information is essential to a determination of monthly profit or loss of a manufacturing company?
7. For many years a large corporation has excluded from its statement of cost of production any mention of work in process pointing out that on the average the quantity of goods in process does not vary and as a result has no effect on the total cost of production. Do you agree with this approach? Explain.
8. As a financial accountant concerned with the preparation of operating statements for a manufacturing company, how would you distribute such items as rent, depreciation, heat and light, and officers' salaries to manufacturing overhead, selling expense, and administrative expense if all operations are carried on in one building?
9. "Take the inventory at the beginning of the year, add to it purchases during the year, and subtract the inventory at the end of the year to obtain cost of material consumed."
    - *a*) In what respects does the procedure described above fail to provide an adequate plan of accounting for materials used in manufacturing?
    - *b*) How can these shortcomings be remedied?

Chapter 3

THE MANUFACTURING CYCLE

Periodic Inventory Method vs. Perpetual Inventory Method. The illustrative problem in the last chapter could be completed only if the value of the closing inventories was furnished. This implies that a physical inventory was taken or that some approximation was made. This method is generally used in financial accounting and is referred to as the periodic inventory method of income determination.

The perpetual inventory method generally associated with cost accounting presupposes the existence of additional subsidiary records furnishing inventory values at any given date. As a result, financial statements may be prepared without resorting to the arduous task of a physical inventory. Then, too, such subsidiary records by yielding a so-called book inventory value, permit the verification of the physical inventory, thus pointing up overages and shortages.

Under the perpetual inventory system the key ledger accounts relating to manufacturing, while retaining the titles used in financial accounting, change somewhat in their function and in the nature of debits and credits posted thereto. The purpose of the accounts is to trace the flow of costs to correspond to the flow of work from raw material to work in process to finished goods to cost of sales. The accounts reflect the so-called manufacturing cycle, since the operations are endlessly repeated.

Cost Controlling Accounts. Controlling accounts are very widely used in cost accounting because of the great mass of details contained in the cost records. The principal cost controlling accounts and the corresponding subsidiary ledgers are listed below:

Controlling Account	*Subsidiary Ledger*
Stores	Stores Ledger
Work in Process	Job Order Cost Sheets or Process Cost Sheets
Finished Parts	Finished Parts Ledger
Finished Goods	Finished Goods Ledger
Manufacturing Overhead	Manufacturing Overhead Ledger and/or Departmental Overhead Ledger
Selling Expense	Selling Expense Ledger
Administrative Expense	Administrative Expense Ledger

Stores Ledger. In actual practice specialized types of ledger sheets are used in place of the conventional two-sided ledger account. Accounts in the stores ledger are generally kept on cards with a separate card for each item kept in the storeroom. The essential information shown relates to quantities received, quantities issued, quantities on hand, and unit costs. Finished parts and finished goods ledgers are operated in the same way as the stores ledger.

Work in Process Ledgers. Cost systems may conveniently be classified as either process costs or job order costs. In a process cost system, product unit costs are determined by dividing the number of units produced into the total cost for a given period of time. All units produced during the period have the same average cost. For example, in a plant manufacturing ginger ale the production costs are averaged over the number of cases of ginger ale produced during the month. The detailed costs are shown on so-called process cost sheets constituting the subsidiary ledger. These sheets contain the material, labor, and manufacturing overhead charged to each process.

PRODUCING DEPARTMENT "A" EXPENSES

Date	Folio	Total	A Indirect Mat'l	B Fixed Charges	C Power & Light	D Indirect Labor	E Repairs	F Miscell. Charges	G Apportioned Charges		
1/31		400 –				400 –					
1/31		300 –	300 –								
1/31		400 –		400 –							
1/31		125 –			125 –						
1/31		22 22			22 22						
1/31		100 –		100 –							
1/31		114 –		114 –							
1/31		100 –					100 –				
1/31		30 –						30 –			
1/31		171 39							171 39		
		1762 61	300 –	614 –	147 22	400 –	100 –	30 –	171 39		

FIGURE 5. Departmental Expense Ledger Sheet

Under a job order cost system each specific order or lot of product is treated as a unit and its cost determined separately. A cost sheet is set up for each order and on it are entered the costs of material and labor used and the overhead applicable to the order. These cost sheets constitute the work in process ledger. The sum of the costs entered on individual cost sheets should agree with the total cost of work in process shown in the control account or accounts.

Manufacturing Overhead and Selling Expense Ledgers. The manufacturing overhead ledger is ordinarily subdivided by departments and contains a ledger sheet for each department. The departmental ledger sheets in turn have columns for individual expense items (Figure 5). All money columns on these ledger sheets are debit columns since entries in the overhead accounts are almost always debits. At the end of the month, the sum of the items shown on a ledger sheet shows the total overhead incurred by that department during the month. The totals of all the sheets in the ledger should, of course, agree with the balance in Manufacturing Overhead.

The selling expense and administrative expense ledgers are composed of columnar expense sheets similar to those used for manufacturing overhead (Figure 6).

Material Costs. Materials are commonly purchased in advance of the time they are to be used and are kept in a storeroom. The cost of the materials on hand is shown in the Raw Materials Inventory account or Stores. Operation of the Stores account is summarized below.

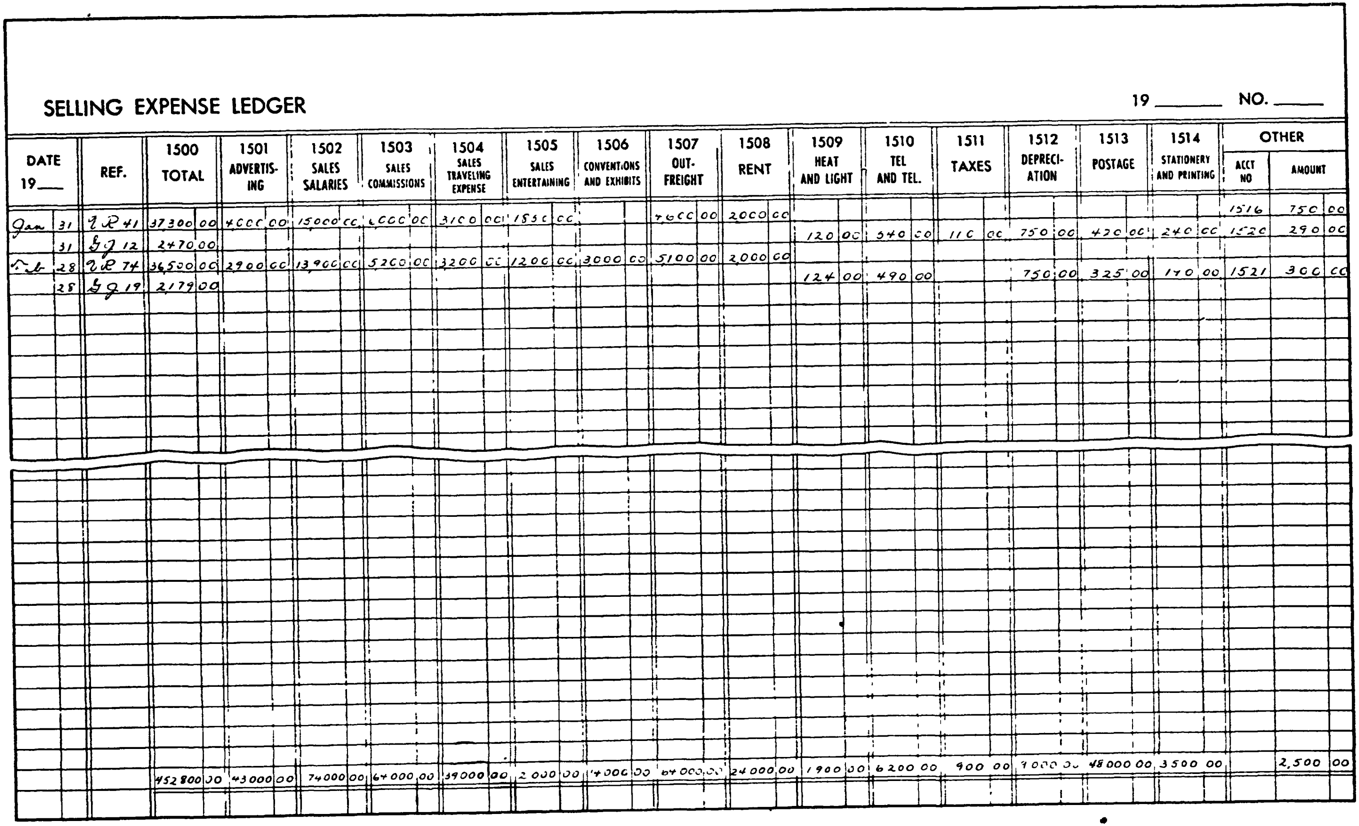
STORES

Dr.	Cr.
1. With the inventory at the beginning of the period.	1. With the cost of direct materials requisitioned; at the same time debit Work in Process.
2. With the invoice price of purchases; at the same time credit Vouchers Payable.	2. With the cost of indirect materials; at the same time debit Manufacturing Overhead.
3. With freight-in; at the same time credit Vouchers Payable.	3. With the cost of materials returned to vendors; at the same time debit Vouchers Payable.
4. With materials returned from the factory; at the same time credit Work in Process.	

The balance of this account represents a current asset.

Labor Costs. Employees of the company work at their respective tasks in the factory and the wages they earn are debited to Factory Payroll. The corresponding credit is to Accrued Payroll which shows the liability for the salaries and wages owed to employees. Factory Payroll is in effect a clearing account used to accumulate the cost of labor. At the end of the period the debit balance in Factory Payroll is transferred to other accounts as follows:

1. The cost of direct labor is transferred to Work in Process.
2. The cost of indirect labor is transferred to Manufacturing Overhead.



SELLING EXPENSE LEDGER

19_____ NO. _____

DATE 19__		REF.	1500 TOTAL	1501 ADVERTISING	1502 SALES SALARIES	1503 SALES COMMISSIONS	1504 SALES TRAVELING EXPENSE	1505 SALES ENTERTAINING	1506 CONVENTIONS AND EXHIBITS	1507 OUT-FREIGHT	1508 RENT	1509 HEAT AND LIGHT	1510 TEL AND TEL.	1511 TAXES	1512 DEPRECIATION	1513 POSTAGE	1514 STATIONERY AND PRINTING	OTHER ACCT NO	OTHER AMOUNT
Jan	31	VR 41	37300 00	4000 00	15000 00	6000 00	3100 00	1550 00		4600 00	2000 00							1516	750 00
	31	GJ 12	2470 00									120 00	540 00	110 00	750 00	420 00	240 00	1520	290 00
Feb	28	VR 74	36500 00	2900 00	13,900 00	5200 00	3200 00	1200 00	3000 00	5100 00	2,000 00								
	28	GJ 19	2179 00									124 00	490 00		750 00	325 00	170 00	1521	300 00
			452800 00	43000 00	74000 00	64000 00	39000 00	2000 00	14000 00	64000 00	24000 00	1900 00	6200 00	900 00	7000 00	48000 00	3500 00		2,500 00

FIGURE 6. Selling Expense Ledger

Operation of Factory Payroll and Accrued Payroll is summarized below.

Dr.	Cr.
FACTORY PAYROLL	
1. With salaries and wages earned by employees during the period; at the same time credit Accrued Payroll account.	1. With the cost of direct labor; at the same time debit Work in Process.
	2. With the cost of indirect labor; at the same time debit Manufacturing Overhead.

Dr.	Cr.
ACCRUED PAYROLL	
1. With the amount of wages to be paid; at the same time credit Vouchers Payable.	1. With the amount of wages earned by employees; at the same time debit Factory Payroll.

After the books have been closed, Factory Payroll has no balance since labor costs have been transferred to other accounts; the Accrued Payroll account will have a credit balance equal to the amount of wages earned by employees but not yet paid. The date on which the books are closed is ordinarily not the same as that on which wage payments are made and, in addition, payments may lag behind the work by a few days because it requires time to prepare the payroll. Hence there will usually be some wages owing to employees. This balance in Accrued Payroll is a current liability and appears in the balance sheet.

Manufacturing Overhead. All the indirect charges to manufacturing are collected in a manufacturing overhead account. Like the Factory Payroll account, Manufacturing Overhead is a clearing account used to accumulate the indirect costs of production. These costs are subsequently transferred to Work in Process leaving no balance in Manufacturing Overhead after the books have been closed.[1] Operation of the Manufacturing Overhead account is summarized below.

Dr.	Cr.
MANUFACTURING OVERHEAD	
1. With the cost of indirect materials; at the same time credit Stores.	1. With overhead cost applied to work in process; at the same time debit Work in Process.
2. With the cost of indirect labor; at the same time credit Factory Payroll.	
3. With the amount of manufacturing overhead from voucher register; at the same time credit Vouchers Payable.	
4. With the amount of insurance, taxes, depreciation, etc. according to the respective schedules; at the same time credit the accounts Prepaid Insurance, Prepaid or Accrued Taxes, Allowance for Depreciation, respectively.	

---

[1] It is assumed here that the actual amount of manufacturing overhead is charged to cost of goods produced during the period. Other methods are presented in later chapters.

Work in Process Inventory. The nature of the work in process inventory has already been explained. Operation of the account is explained below.

WORK IN PROCESS

Dr.	Cr.
1. With the cost of the inventory, consisting of material, labor, and overhead at the beginning of the period.	1. With the cost of material, labor, and overhead of finished parts and finished goods completed during the period; at the same time debit Finished Parts and/or Finished Goods.
2. With the amount of direct materials issued during period for use on production orders; at the same time credit Stores.	2. With the cost of materials returned to storeroom; at the same time debit Stores.
3. With the amount of direct labor applied to production orders during period; at the same time credit Factory Payroll.	
4. With the amount of overhead applied to production orders during period; at the same time credit Manufacturing Overhead.	

The balance of this account represents the cost of the inventory still in process. Such cost includes the costs of material, labor, and manufacturing overhead.

Subdivision of Work in Process Account. It is often advisable to break up Work in Process into its component elements in order to maintain separate control over each cost element. Where this is done the individual work in process accounts appear as follows:

MATERIAL IN PROCESS

Dr.	Cr.
1. With cost of material on hand at the beginning of the period.	1. With cost entered on the completed finished parts and finished goods orders; at the same time debit Finished Parts and Finished Goods.
2. With direct materials issued during the period for production orders; at the same time credit Stores.	2. With cost of materials returned to stores; at the same time debit Stores.
3. With finished parts issued during period for subassemblies and finished goods; at same time credit Finished Parts.	

The balance of this account represents the amount of materials in process, or unfinished work, and should agree with the material costs on various cost sheets of unfinished orders.

LABOR IN PROCESS

Dr.	Cr.
1. With cost of direct labor in process at the beginning of the period.	1. With cost of direct labor on the completed finished parts and finished goods orders; at the same time debit Finished Parts and Finished Goods, respectively.
2. With direct labor applied to production orders during the period; at the same time credit Factory Payroll.	

The balance of this account represents the amount of direct labor in process and should agree with the direct labor section on the various cost sheets of unfinished orders.

Dr.	MANUFACTURING OVERHEAD IN PROCESS Cr.
1. With applied overhead in process at the beginning of the period.	1. With expense applied to the completed finished parts and finished goods orders; at the same time debit Finished Parts and Finished Goods.
2. With overhead applied to production orders during the period; at the same time credit Manufacturing Overhead.	

The balance of this account represents the amount of applied overhead in process and should agree with the manufacturing overhead section on the various cost sheets of unfinished orders.

In those cases where finished parts are manufactured and later assembled into finished goods it is advisable to open additional accounts for finished parts and for the assembly operation or operations. Finished parts emerge from work in process and are sent to a finished parts storeroom in case they are not immediately needed. The entry to show the transfer is to debit Finished Parts and credit Work in Process. The finished parts may then be sold as replacement parts or be reissued to the factory for use in the assembly line. The operation of the Finished Parts account is illustrated below:

Dr.	FINISHED PARTS Cr.
1. With inventory of parts at beginning of period consisting of costs of material, labor, and overhead.	1. With cost of parts sold; at the same time debit Cost of Sales.
2. With cost of parts produced during period; at the same time credit Work in Process.	2. With cost of parts moved to assembly; at the same time debit Assembly.
3. With returns from customers; at the same time credit Cost of Sales.	

The balance in the account is the cost of the parts inventory in the stockroom, consisting of material, labor, and overhead charges.

The assembly account is in effect an additional work in process account since it is debited for the cost of the finished parts, any additional material used in assembly, such as nuts and bolts, assembly labor, and assembly overhead. It is credited for the cost of the completed product. By means of such an account it is possible to portray in the manufacturing cost statement or schedule the flow of costs through the *various stages of manufacture*. The operation of the account is illustrated below:

ASSEMBLY

Dr.	Cr.
1. With inventory of all materials in assembly at beginning of the period. These include the cost of all finished parts in process of being assembled and any additional materials, labor, and overhead used in assembly.	1. With the cost of assembled products; at the same time debit Finished Goods.
2. With additional finished parts reissued to factory from finished parts stock; at the same time credit Finished Parts.	
3. With cost of completed parts purchased; at the same time credit Vouchers Payable.	
4. With additional assembly materials required to meet production schedules; at the same time credit Stores.	
5. With cost of assembly labor; at the same time credit Factory Payroll.	
6. With manufacturing overhead incurred in assembly; at the same time credit Manufacturing Overhead.	

The balance of the account is the cost of the inventory in process of assembly and represents all material, labor, and overhead incurred on partially completed assemblies.

In companies that do not use an assembly account, the completed finished parts are charged to Finished Parts and credited to Work in Process. Upon being reissued to the factory for assembly, they would be charged back to Work in Process and upon completion, charged to Finished Goods and credited to Work in Process.

Finished Goods. This represents the final stage. When the goods have been completed they are charged to Finished Goods, the credit being either to Work in Process or Assembly. Ordinarily the responsibility of the factory ceases with the transfer to the finished goods stockroom. At this point the sales department takes over. The account itself is operated as follows:

FINISHED GOODS

Dr.	Cr.
1. With inventory on hand at beginning of period.	1. With cost of finished goods sold; at the same time debit Cost of Sales.
2. With goods completed during period; at the same time credit Work in Process account or accounts.	
3. With returns from customers; at the same time credit Cost of Sales.	

The balance of the account represents the cost of inventory of finished goods on hand at the end of the period.

Cost of Goods Sold. The preceding explanation has shown how the manufacturing cost of finished goods ready for sale has been built up by accumulating the costs of material, labor, and overhead in the ledger accounts. When the finished goods are sold, the cost of the goods is debited to Cost of Sales and credited to Finished Goods in recognition of the fact that the goods have passed into possession of the buyer. This entry is in addition to the regular financial entry debiting Accounts Receivable and crediting Sales. Operation of the Cost of Sales account is shown below.

COST OF SALES

Dr.	Cr.
1. With amounts of finished parts sold; at the same time credit Finished Parts.	1. With amount of returns from customers; at the same time debit Finished Parts or Finished Goods, as the case may be.
2. With the amount of finished goods sold; at the same time credit Finished Goods.	

The balance of this account is closed to Profit and Loss whenever the books are closed.

Selling and Administrative Expenses. Expenses connected with the activities of the sales and general administrative divisions are recorded in the usual way through the ledger accounts. It is usually more convenient to keep in the general ledger only a controlling account for each of these two major divisions and to record the details through subsidiary ledgers, one for each division.

Product Charges vs. Period Charges. Selling and administrative expenses are commonly spoken of as period charges in contrast to manufacturing overhead which is referred to as a product charge. The latter term implies that manufacturing overhead is eventually charged to the product and becomes part of the inventory cost along with material and labor. Any inventories remaining at the end of a period are therefore carried over to the next period and are shown in the balance sheet at a cost comprising material, labor, and manufacturing overhead. By contrast, selling and administrative expenses are charged to profit and loss; that is, they are expenses of the period for which they were incurred. No part of them becomes capitalized in inventories. Opinion on this point is not entirely unanimous. Some cost accountants have urged the apportionment of general administrative expenses between selling and manufacturing; thus the portion charged to manufacturing overhead would result in a product charge and be reflected in inventory. General opinion, however, favors exclusion of general administrative expense from inventories. The cost of manufacturing may therefore be considered as made up of the costs to cover direct material, direct labor, and manufacturing overhead; that is, the cost of goods ready for sale and shipment. On the other hand, certain classes of manufacturing overhead are often excluded from inventories.

Cost Accounting Problem Illustration

Statement of Problem. In the illustration which follows, a hypothetical cost accounting problem is presented and solved. It embraces the foregoing principles and shows how they are applied in the records and the resulting summaries. All transactions are entered in one journal for convenience; they are traced through to the general ledger accounts, the trial balance, and the financial statements. Figures used in this problem are, with some modification in the method of presentation, the same as those used in the demonstration in Chapter 2, the object being to make a comparison between the financial and the cost accounting procedures.

1. The opening trial balance of the Sullivan Manufacturing Corporation, January 1, 19—, was as follows:

Imprest Cash Fund	$ 500.00	
Cash	20,000.00	
Accounts Receivable	10,000.00	
Notes Receivable	5,000.00	
Stores	10,000.00	
Work in Process	15,000.00	
Finished Goods	12,000.00	
Machinery and Equipment	57,600.00	
Furniture and Fixtures	3,600.00	
Prepaid Insurance	1,500.00	
Vouchers Payable		$ 12,000.00
Notes Payable		2,000.00
Allowance for Depreciation of Machinery and Equipment		5,760.00
Allowance for Depreciation of Furniture and Fixtures		540.00
Capital Stock		100,000.00
Retained Earnings		14,900.00
	$135,200.00	$135,200.00

2. The summary of the voucher register for the month of January was as follows:

Purchases of Raw Materials and Supplies		$20,000.00
Payroll		40,800.00
Notes Payable		1,000.00
Rent, to be apportioned on the basis of floor area as follows:		
Manufacturing	$1,700.00	
Selling	150.00	
Administrative	150.00	2,000.00
Power		500.00
Light, to be apportioned on the basis of kilowatt hours as follows:		
Manufacturing	$ 105.00	
Selling	9.00	
Administrative	11.00	125.00

Office Supplies, to be apportioned on the basis of actual use:		
Manufacturing	$ 50.00	
Selling	25.00	
Administrative	25.00	$ 100.00
Repairs to Machinery		500.00
General Manufacturing Expenses		110.00
Salesmen's Salaries		1,500.00
Office Salaries		2,000.00
Total Vouchers Payable		$68,635.00

3. The analysis of the payroll for the month disclosed the following facts:

Direct Labor	$41,500.00	
Indirect Labor	2,700.00	
Total Payroll Earned		$44,200 00

4. From an analysis of the materials issued during the month, the results were as follows:

Direct Materials	$20,800.00	
Indirect Materials	1,200.00	
Total		$22,000.00

5. Power costs $500 per month all of which is charged to manufacturing.

6. Depreciation on machinery and equipment is figured at the rate of 10% per annum, and on furniture and fixtures at 15%. It is distributed as follows:

Manufacturing Overhead	$480.00
Selling Expense	15.00
Administrative Expense	30.00

7. Insurance on equipment, stock, and for compensation in case of accident is distributed on the basis of values of equipment and payroll. The amounts are as follows:

Manufacturing Overhead	$513.00
Selling Expense	20.00
Administrative Expense	4.00

8. The total manufacturing overhead for the month is charged to production.

9. The completed production and its cost during the month are arrived at as follows:

Inventory work in process at beginning	10,000	units
Put into process	34,000	"
Total work in process to be accounted for	44,000	"
Total debits to work in process	$85,158	
Average unit cost of production * $85,158 ÷ 44,000 =	$1.9354	
Finished production transferred	33,417	units
Value of transfer (to nearest dollar) 33,417 × $1.9354	$64,675	

10. The sales and cost of sales during the month were as follows:

Sales	$62,000.00
Cost of Sales	55,675.00

11. The sales returns, cost of sales returns, and sales allowances during the month were:

Sales Returns	$250.00
Cost of Sales Returns	200.00
Sales Allowances	300.00

12. Cash receipts:

Accounts Receivable	$60,000.00	
Less: Cash Discounts on Sales	1,200.00	$58,800.00
Notes Receivable		3,000.00
Total		$61,800.00

13. Cash disbursements:

Vouchers Payable	$60,000.00	
Less: Cash Discounts on Purchases	1,000.00	$59,000.00

14. Notes were given in the amount of $3,000 in payment of vouchers payable. Notes were received in the amount of $2,000 in payment of open accounts.

15. A provision for bad debts was made in the amount of $310.

Requirements:

1. Journal entries
2. General ledger accounts
3. Trial balance (preclosing)
4. Financial statements

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* Disregarding stages of completion of work in process inventories.

JOURNAL ENTRIES

January 31, 19—

Stores	$20,000.00	
Accrued Payroll	40,800.00	
Notes Payable	1,000.00	
Manufacturing Overhead	2,965.00	
Selling Expense	1,684.00	
Administrative Expense	2,186.00	
Vouchers Payable		$68,635.00

To summarize the materials bought and expenses incurred during the month as listed in the voucher register arrived at as follows:

Manufacturing Overhead	
Rent	$1,700.00
Power	500.00
Light	105.00
Office Supplies	50.00
Repairs to Machinery	500.00
General Manufacturing Expense	110.00
	$2,965.00

Selling Expense:	
Sales Salaries	$1,500.00
Rent	150.00
Light	9.00
Office Supplies	25.00
	$1,684.00

Administrative Expense:	
Office Salaries	$2,000.00
Rent	150.00
Light	11.00
Office Supplies	25.00
	$2,186.00

- 31 -

Work in Process	$20,800.00	
Manufacturing Overhead	1,200.00	
Stores		$22,000.00

To record the direct and indirect material requisitioned during the month as per analysis of the materials issued.

- 31 -

Work in Process	$41,500.00	
Manufacturing Overhead	2,700.00	
Accrued Payroll		$44,200.00

To record the amount of direct and indirect labor as per payroll and labor time tickets.

- 31 -

Manufacturing Overhead	$ 480.00	
Selling Expense	15.00	
Administrative Expense	30.00	
Allowance for Depreciation on Machinery and Equipment		$ 480.00
Allowance for Depreciation on Furniture and Fixtures		45.00

To charge depreciation for the month to the above divisions of the plant. Rates: Machinery and Equipment 10%, Furniture and Fixtures 15%.

- 31 -

Manufacturing Overhead	$ 513.00	
Selling Expense	20.00	
Administrative Expense	4.00	
Prepaid Insurance		$ 537.00

For monthly charge for fire insurance on equipment and stock, and for compensation insurance. This expense is distributed on the basis of values and payroll.

- 31 -

Work in Process	$ 7,858.00	
Manufacturing Overhead		$7,858.00

To charge the total manufacturing overhead for the month to goods in process.

- 31 -

Finished Goods	$64,675.00	
Work in Process		$64,675.00

To record the completed production during the month.

- 31 -

Cost of Sales	$55,675.00	
Finished Goods		$55,675.00

To record the cost of sales during the month.

- 31 -

Accounts Receivable	$62,000.00	
Sales		$62,000.00

For sales made during January.

- 31 -

Finished Goods	$ 200.00	
Cost of Sales		$ 200.00

To record the cost of sales returns during January.

- 31 -

Sales Returns	$ 250.00	
Sales Allowances	300.00	
Accounts Receivable		$ 550.00

To record the returns and allowances during the month.

- 31 -

Cash	$61,800.00	
Cash Discount on Sales	1,200.00	
Accounts Receivable		$60,000.00
Notes Receivable		3,000.00

To record payments by customers and collection of notes during the month.

- 31 -

Vouchers Payable	$60,000.00	
Cash Discount on Purchases		$ 1,000.00
Cash		59,000.00

To record cash disbursements during the month.

- 31 -

Vouchers Payable	$ 3,000.00	
Notes Payable		$ 3,000.00

To record noninterest-bearing notes issued during the month.

- 31 -

Notes Receivable	$ 2,000.00	
Accounts Receivable		$ 2,000.00
To record notes received during January.		

- 31 -

Bad Debts Expense	$ 310.00	
Allowance for Bad Debts		$ 310.00
To provide a reserve for bad debts.		

(Note: At this point a trial balance is taken.)

CLOSING ENTRIES

January 31, 19—

Profit and Loss	$61,474.00	
Cost of Sales		$55,475.00
Sales Returns		250.00
Sales Allowances		300.00
Selling Expenses		1,702.00
Administrative Expenses		2,237.00
Cash Discount on Sales		1,200.00
Provision for Bad Debts		310.00

- 31 -

Sales	$62,000.00	
Cash Discount on Purchases	1,000.00	
Profit and Loss		$63,000.00

- 31 -

Profit and Loss	$ 1,526.00	
Retained Earnings		$ 1,526.00
To close.		

GENERAL LEDGER ACCOUNTS

IMPREST CASH FUND

1/1	Balance	$ 500.00	1/31	Balance	$ 500.00
2/1	Balance	$ 500.00			

CASH IN BANK

1/1	Balance	$ 20,000.00	1/31	Disbursements	$ 59,000.00
1/31	Receipts	61,800.00	1/31	Balance	22,800.00
		$ 81,800.00			$ 81,800.00
2/1	Balance	$ 22,800.00			

ACCOUNTS RECEIVABLE

1/1	Balance	$ 10,000.00	1/31	Sales Returns	$ 550.00
1/31	Sales	62,000.00	1/31	Cash	60,000.00
			1/31	Notes	2,000.00
			1/31	Balance	9,450.00
		$ 72,000.00			$ 72,000.00
2/1	Balance	$ 9,450.00			

NOTES RECEIVABLE

1/1	Balance	$ 5,000.00	1/31	Cash	$ 3,000.00
1/31	Accounts Receivable	2,000.00	1/31	Balance	4,000.00
		$ 7,000.00			$ 7,000.00
2/1	Balance	$ 4,000.00			

STORES

1/1	Balance	$ 10,000.00	1/31	Requisitions	$ 22,000.00
1/31	Purchases	20,000.00	1/31	Balance	8,000.00
		$ 30,000.00			$ 30,000.00
2/1	Balance	$ 8,000.00			

WORK IN PROCESS

1/1	Balance	$ 15,000.00	1/31	Completed Cost Sheets	$ 64,675.00
1/31	Direct Material	20,800.00	1/31	Balance	20,483.00
1/31	Direct Labor	41,500.00			
1/31	Manufacturing Overhead	7,858.00			
		$ 85,158.00			$ 85,158.00
2/1	Balance	$ 20,483.00			

FINISHED GOODS

1/1	Balance	$ 12,000.00	1/31	Requisitions	$ 55,675.00
1/31	Production	64,675.00	1/31	Balance	21,200.00
1/31	Returns	200.00			
		$ 76,875.00			$ 76,875.00
2/1	Balance	$ 21,200.00			

MACHINERY AND EQUIPMENT

1/1	Balance	$ 57,600.00	1/31	Balance	$ 57,600.00
2/1	Balance	$ 57,600.00			

FURNITURE AND FIXTURES

1/1	Balance	$ 3,600.00	1/31	Balance	$ 3,600.00
2/1	Balance	$ 3,600.00			

PREPAID INSURANCE

1/1	Balance	$ 1,500.00	1/31	Expired	$ 537.00
			1/31	Balance	963.00
		$ 1,500.00			$ 1,500.00
2/1	Balance	$ 963.00			

VOUCHERS PAYABLE

1/1	Cash	$ 60,000.00	1/1	Balance	$ 12,000.00
1/31	Notes	3,000.00	1/31	Vouchers	68,635.00
1/31	Balance	17,635.00			
		$ 80,635.00			$ 80,635.00
			2/1	Balance	$ 17,635.00

NOTES PAYABLE

1/31	Vouchers	$ 1,000.00	1/1	Balance	$ 2,000.00
1/31	Balance	4,000.00	1/31	Vouchers	3,000.00
		$ 5,000.00			$ 5,000.00
			2/1	Balance	$ 4,000.00

ACCRUED PAYROLL

1/31	Vouchers	$ 40,800.00	1/31	Earned	$ 44,200.00
1/31	Balance	3,400.00			
		$ 44,200.00			$ 44,200.00
			2/1	Balance	$ 3,400.00

ALLOWANCE FOR DEPRECIATION OF MACHINERY AND EQUIPMENT

1/31	Balance	$ 6,240.00	1/1	Balance	$ 5,760.00
			1/31		480.00
		$ 6,240.00			$ 6,240.00
			2/1	Balance	$ 6,240.00

ALLOWANCE FOR DEPRECIATION OF FURNITURE AND FIXTURES

1/31	Balance	$ 585.00	1/1	Balance	$ 540.00
			1/31		45.00
		$ 585.00			$ 585.00
			2/1	Balance	$ 585.00

ALLOWANCE FOR BAD DEBTS

1/31	Balance	$ 310.00	1/31		$ 310.00
			2/1	Balance	$ 310.00

CAPITAL STOCK

1/31	Balance	$100,000.00	1/1	Balance	$100,000.00
			2/1	Balance	$100,000.00

RETAINED EARNINGS

1/31	Balance	$ 16,426.00	1/1	Balance	$ 14,900.00
			1/31	Net Profit	1,526.00
		$ 16,426.00			$ 16,426.00
			2/1	Balance	$ 16,426.00

PROFIT AND LOSS

1/31	Cost of Sales	$ 55,475.00	1/31	Sales	$ 62,000.00
1/31	Sales Returns	250.00	1/31	Cash Discount on Purchases	1,000.00
1/31	Sales Allowances	300.00			
1/31	Selling Expense	1,719.00			
1/31	Administrative Expense	2,220.00			
1/31	Cash Discount on Sales	1,200.00			
1/31	Provision for Bad Debts	310.00			
1/31	Net Profit	1,526.00			
		$ 63,000.00			$ 63,000.00

SALES

1/31	Profit and Loss	$ 62,000.00	1/31		$ 62,000.00

COST OF SALES

1/31	Shipment	$ 55,675.00	1/31	Returns	$ 200.00
			1/31	Profit and Loss	55,475.00
		$ 55,675.00			$ 55,675.00

SALES RETURNS

1/31		$ 250.00	1/31	Profit and Loss	$ 250.00

SALES ALLOWANCES

1/31		$ 300.00	1/31	Profit and Loss	$ 300.00

MANUFACTURING OVERHEAD

1/31	General Factory Expense	$ 110.00	1/31	Work in Process	$ 7,858.00
1/31	Indirect Material	1,200.00			
1/31	Indirect Labor	2,700.00			
1/31	Rent	1,700.00			
1/31	Light	105.00			
1/31	Power	500.00			
1/31	Depreciation	480.00			
1/31	Insurance	513.00			
1/31	Office Supplies	50.00			
1/31	Repairs	500.00			
		$ 7,858.00			$ 7,858.00

SELLING EXPENSE

1/31	Vouchers	$ 1,500.00	1/31	Profit and Loss	$ 1,719.00
1/31	Rent	150.00			
1/31	Light	9.00			
1/31	Depreciation	15.00			
1/31	Insurance	20.00			
1/31	Office Supplies	25.00			
		$1,719.00			$1,719.00

ADMINISTRATIVE EXPENSES

1/31	Vouchers	$ 2,000.00	1/31	Profit and Loss	$ 2,530.00
1/31	Rent	150.00			
1/31	Light	11.00			
1/31	Depreciation	30.00			
1/31	Insurance	4.00			
1/31	Office Supplies	25.00			
1/31	Bad Debts	310.00			
		$ 2,530.00			$ 2,530.00

CASH DISCOUNT ON SALES

1/31		$ 1,200.00	1/31	Profit and Loss	$ 1,200.00

BAD DEBTS EXPENSE

1/31		$ 310.00	1/31	Profit and Loss	$ 310.00

CASH DISCOUNT ON PURCHASES

1/31	Profit and Loss	$ 1,000.00	1/31		$ 1,000.00

For trial balance, see page 55.

Summary. A number of conclusions may now be drawn based on the demonstrations in the previous chapter and in the present one. First, it may be noted that the cost presentation emphasizes a cumulative flow of costs from one account to the next until the result emerges in Cost of Sales. This was not true in financial accounting where the final results had to be pulled together, as it were, from various bits of information. In financial accounting, after the trial balance was taken, many adjusting entries and hence a work sheet were necessary before the accounts could be closed to Profit and Loss. In cost accounting these were not necessary; even the month-end adjustments are part of the normal cost routine and are incorporated in the cost accounts before the trial balance stage is reached. In financial accounting the inventories are usually determined by physical count; in cost accounting they are based on figures contained in the cost accounts themselves.

SULLIVAN MANUFACTURING CORPORATION
TRIAL BALANCE, JANUARY 31, 19—
(BEFORE CLOSING)

Imprest Cash Fund	$ 500.00	
Cash	22,800 00	
Accounts Receivable	9,450.00	
Notes Receivable	4,000.00	
Stores	8,000.00	
Work in Process	20,483 00	
Finished Goods	21,200.00	
Machinery and Equipment	57,600.00	
Furniture and Fixtures	3,600.00	
Prepaid Insurance	963.00	
Vouchers Payable		$ 17,635.00
Notes Payable		4,000.00
Accrued Payroll		3,400.00
Allowance for Depreciation of Machinery and Equipment		6,240.00
Allowance for Depreciation of Furniture and Fixtures		585.00
Allowance for Bad Debts		310.00
Capital Stock		100,000.00
Retained Earnings		14,900.00
Sales		62,000.00
Sales Returns	250.00	
Sales Allowances	300.00	
Cost of Sales	55,475.00	
Selling Expenses	1,719.00	
Administrative Expenses	2,530.00	
Discount on Sales	1,200.00	
Discount on Purchases		1,000.00
	$210,070.00	$210,070.00

Note: The profit and loss statement and balance sheet resulting from the above figures are the same as those in Chapter 2 and are therefore not repeated here.

A comparison of the preclosing trial balance in Chapter 2 with the trial balance in this chapter is also illuminating. In the former, the inventories at January 31 still reflect the opening balances because the accounts are not used as operating accounts but only as inventory accounts. It is not until they have been adjusted that they show the closing balances. In the present chapter, the inventory accounts in the trial balance show the closing inventories automatically. In financial accounting there is no Cost of Sales account in the preclosing trial balance, but it does appear under the cost procedure since costing sales represents the last step in the flow of costs.

Finally it may be noted that the same results are obtained so far as the financial statements are concerned. This, however, is more apparent than real; in fact it is wholly accidental. It was assumed in the demonstration that the *actual* overhead incurred in production was charged to Work in Process. In practice this is seldom the case. Predetermined overhead is applied to the product and since this rarely coincides with the actual overhead, the inventories of work in process, finished parts, and finished goods may all be charged with different amounts of overhead than would be the case under financial accounting where actual overhead is used. This matter of the use of predetermined overhead in cost accounting and of the disposition of the difference between actual and applied overhead is one of the important topics in cost accounting and is presented later.

QUESTIONS

1. Contrast the function of the Cost of Goods Manufactured account under a system of periodic inventory with the Work in Process accounts under a system of perpetual inventory.
2. List five controlling accounts used in a cost system and the subsidiary ledgers required in support of these accounts.
3. Indicate the kind of cost system, job order or process, used by companies engaged in manufacturing:
   - *a*) Textbooks
   - *b*) Steel rails
   - *c*) Period furniture
   - *d*) Heavy electrical apparatus
   - *e*) Rubber tires
   - *f*) Corrugated containers
   - *g*) Men's suits
   - *h*) Paints
   - *i*) Metal castings
   - *j*) Canned food
4. List ten expenses which might be classified as manufacturing overhead. How would these expenses be recorded in the subsidiary manufacturing overhead ledger?
5. Explain the function of the Stores account in a system of perpetual inventory by comparison with the accounting treatment of materials under the periodic system.
6. List the advantages of the perpetual inventory system of accounting for materials.
7. What is meant by a "clearing account"? Illustrate.
8. Where a cost accounting system is used, there is no need for an adjusting entry accruing factory labor at the end of the period. Explain by illustration in the form of "T" accounts.
9. In connection with your task of convincing a company executive of the advantages of a cost accounting system, how would you explain the difference as to the point in time when labor and materials are classified as direct or indirect?
10. *a*) What are the subdivisions of the Work in Process account?
    b) What are the advantages of this type of subdivision?
11. Contrast the operation of a single Work in Process account in a plant engaged in the processing of canned peas with the type of account or

accounts necessary to accumulate costs in a plant manufacturing electric broilers. The latter plant makes the heating elements used in its own electric broilers and also sells them as components to other manufacturers of broilers.

12. The Martin Manufacturing Co. was organized on April 1 to manufacture and sell a new type of windshield wiper blade. During the first six months the sales department secured orders in the amount of $200,000 incurring $28,000 in selling expenses (salesmen's salaries, traveling expense, advertising, etc.). During the same period the factory started operations and by September 30 had produced $240,000 worth of blades valued at cost to produce. Administrative expense during the period amounted to $12,000. Since all orders were marked for delivery after October 21, no goods had been shipped.

    Explain the results of operations for the six months ended September 30, stressing the significance of product and period costs.

13. Where perpetual inventories are kept, the balances in the Stores, Work in Process, and Finished Goods accounts represent the end of period inventories. Are physical inventories required under such a system? Explain.

14. Whatever system of inventory accounting is employed, periodic or perpetual, the profit or loss derived must be the same since in either case costs and expenses are deducted from revenue. Do you agree? Explain.

15. Indicate the subsidiary ledger to be used as a source for determining:
    a) Cost of completing Job No. 405
    b) Cost per gallon of cutting oil used on automatic screw machines
    c) Cost per yard of cotton fabric
    d) Manufacturing overhead of the assembly department in a plant manufacturing cigarette lighters

Chapter 4

BASIC COST RECORDS

The previous chapter traced the costs which appear in financial statements back to the ledger accounts in which they are classified and accumulated. In the course of the discussion the flow of costs through the accounts was explained. This chapter will show how manufacturing transactions originate, what primary records are used in recording these transactions, how the cost accountant uses these primary records as the basis for entries in the accounts, and how control is maintained over the cost records.

Types of Orders

Factory Orders. The work which is done in a factory must be planned and directed. The instructions which tell what is to be done are prepared in the form of factory orders. The latter are authorizations to the factory to commence the operations specified in the orders and are thus the instruments which set the factory wheels in motion. These authorizations should be in written form in order to avoid any misunderstanding as to specifications, purpose, or time limitations. The written order also serves as a form on which to record the details of performance. These are needed by the departments which keep records of inventories, costs, and payrolls.

Production Orders. Of the many kinds of factory orders, the production order is the most important. The latter instructs the factory to make a stated quantity of a specified article. This may be a product manufactured for sale, it may be a component part which will later enter into a product to be sold, or it may be an article or piece of equipment to be used in the factory. Orders of the latter type are sometimes called *construction orders* or *betterment orders.* They result in additions to fixed assets whereas other production orders result in additions to inventories.

Before a production order is issued, all details relating to the order should be planned. For instance, in a machine shop the engineering department specifies the materials to be used, the operations to be performed, and other points relating to the way in which the article is to be manufactured. The drafting department prepares drawings and blueprints to guide the production departments. Thus all necessary instructions relating to an order are prepared. When the preliminary instructions have been assembled, the order is turned over to the planning department. The planning department's function is to put into effect the instructions of the engineering staff. The following steps are then taken:

1. Provision for materials and tools needed
2. Routing the order
3. Scheduling the order

In order to provide for materials and tools needed, inventory records are checked to determine whether or not the materials that will be needed are available. The purchasing department is asked to order materials that are lacking. Any tools needed are made or purchased.

The route that the work is to take through the factory is planned, giving attention to the sequence of operations to be performed. Consideration should be given to the use of economical means of internal transportation and avoidance of unnecessary handling operations. A production schedule is established in order that the work will reach each machine when there is time available for the operation to be performed. The object of scheduling is to keep the order moving and to avoid delays which result when materials fail to arrive when needed or when the loading of work centers is unbalanced and bottlenecks are created in the flow of production. Accurate scheduling is especially important in an operation like the assembly of automobiles where the lack of a single part can completely stop all operations. When the scheduled date to begin work on the order arrives, the order, accompanied by all instructions and blueprints, is sent to the factory. Here a clerk releases the order to the shop foreman at the proper time.

Other Factory Orders. Other factory orders instruct various employees as to what is to be done. Some of the principal orders of this type are:

1. *Purchase order,* which instructs the vendor to ship materials listed on the order
2. *Material or stores requisition,* which instructs the stores clerk to release materials listed on the requisition
3. *Move order,* which instructs the plant transportation department to move designated items of materials, parts, etc., to the place stated on the order
4. *Repair order,* which instructs the maintenance department to repair a designated piece of equipment

5. *Shipping order,* which instructs the shipping department to ship the goods listed to a given address
6. *Voucher,* which authorizes the accountant to make an entry in the accounts

Records of Production Costs. The original orders serve as convenient forms on which to record the costs which were incurred by the action called for by the order. Thus the material requisition after being priced acts as an automatic record of the cost of materials used to fill the production order. The labor time spent working on the order is recorded by factory timekeepers and when the hours shown on the timekeeper's report are multiplied by the employees' pay rates, the cost of labor applied to the order is recorded. These documents constitute the original evidences that transactions affecting costs have taken place and hence they provide the information which the accountant needs to draft entries to be made in the accounts. Manufacturing overhead cannot ordinarily be identified with a specific production order, but is applied to product costs on some estimated basis.

The Voucher System

Definition of Voucher System. The voucher system is a plan of accounting under which all entries affecting general ledger accounts require formal approval of someone responsible for the content of the accounts before the entry is recorded. This approval is recorded on a form called a voucher. The system is most widely applied to accounts payable and explanations of the voucher system are often confined to its use with this class of transactions. However, in actual accounting practice the voucher system is extensively used for other general ledger postings.

The basic purpose of the voucher system, from a procedural standpoint, is to decentralize the work involved in handling the documents and in making entries in the accounts. It is the principle of the division of labor applied to the accounting process in order to safeguard the integrity of the accounts and make the perpetration of fraud and embezzlement more difficult. For example, the tasks of opening mail, entering cash receipts that arrived in the mail, and posting to the ledger should be handled by different persons.

Definition of Voucher. A voucher, as noted above, is a document which authorizes the accountant to make an entry. It is an essential element in management's control over the financial records of the business, for in a large business many accountants and clerks of various grades are used in the work of keeping the accounting records. Only a few of these employees have the training and experience necessary to enable them to analyze transactions into debits and credits to the proper ledger accounts. Furthermore, entries in the accounts should always be supported by proper documentary evidence to show what the transaction was, that it was authorized by the proper person, that the entry made accurately reflects the facts of the transaction, and that its entry in the accounts has been approved by someone responsible for the content of the accounts. The use of the voucher is a safeguard which prevents improper entries in the accounts. It not only serves management as a control over its accounts, but it also makes it possible to justify entries which have been made and to place responsibility for them. This justification is also essential in connection with examinations of the books by the company's auditors or by auditors representing the government in matters of taxes or regulation.

In a large business there are many subordinate executives and the records are kept by employees who have no direct contact with the other employees who order, receive, and use the things for which money is spent. Informal control over expenditures, which is characteristic of a small business, must be replaced by carefully organized control to prevent waste, errors, and fraud. The voucher system provides such a method whereby all purchases must be authorized by an executive with authority to determine whether or not the item is necessary. Invoices are then verified and recorded as liabilities. Checks are issued in payment only after authorization based upon documentary evidence showing that the transaction was in order.

Voucher System Applied to Liabilities. Transactions with creditors are one of the important sources of costs; for equipment, materials, supplies, and services of many kinds must be purchased to operate a manufacturing business. The voucher system is employed to control the recording of liabilities incurred in such purchases. When used for this purpose it has definite advantages:

1. It provides a convenient method for handling and recording liabilities incurred.
2. It provides a means for charging the appropriate accounts with the costs of goods and services purchased.
3. It secures effective control over the rate and volume of disbursements.
4. It provides specific receipts for specific invoices. In this way it minimizes fraud and such errors as double payment of invoices and failure to pay.

Under the voucher system every payment to be made must first be recorded as a liability in the voucher register. The following transactions all require preparation of a voucher and entry in the voucher register:

1. Purchase of materials and supplies
2. Accrual of wages and salaries
3. Purchase of services (electricity, telephone, water; also personal services, such as auditing, legal, and consulting engineering)
4. Purchase of fixed assets
5. Payment of notes
6. Other transactions requiring payment by check (e.g., reimbursement of petty cash)

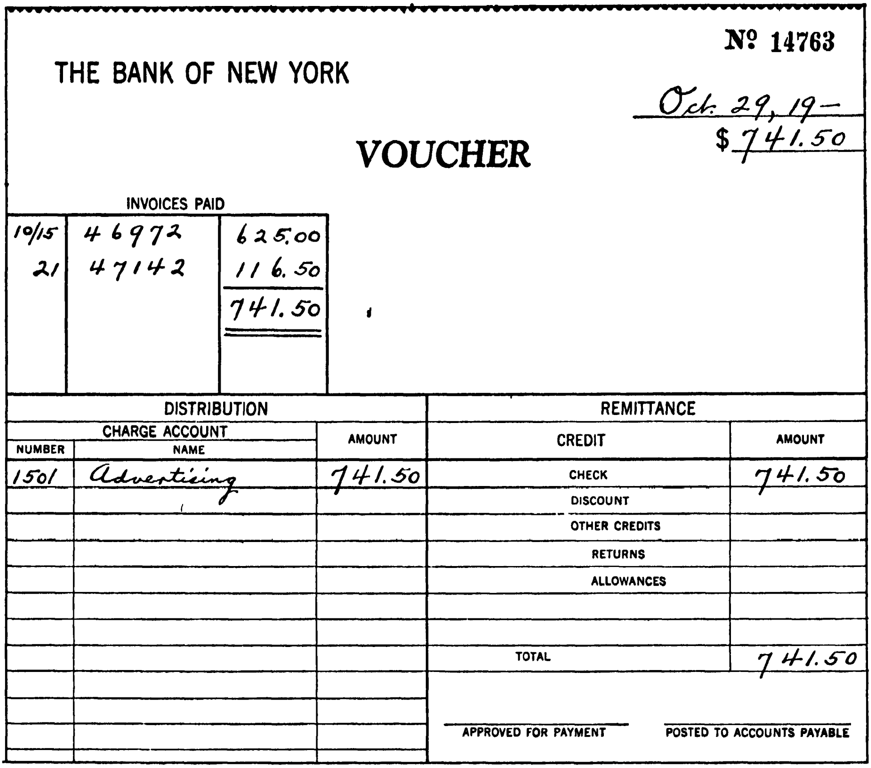
Under the voucher system all payments except those made from petty cash are made by check after being recorded in the voucher register.

Operation of Voucher System. The operation of the voucher system in connection with accounts payable involves the following steps:

1. Preparation of vouchers
2. Entry of vouchers in voucher register
3. Payment of liabilities represented by vouchers
4. Filing and indexing paid vouchers

Preparation of Vouchers. On receipt of an invoice or other document indicating that a liability has been incurred, correctness of the information on the invoice is first verified. For example, the report of goods received is compared with the list of items on the vendor's invoice to make sure that the things charged for have been received. Prices are compared with those on the purchase order and extensions are checked to insure accuracy. This process establishes the fact that the company is obligated to make the payment and proves the amount that should be paid.

Next the voucher is prepared. On the voucher form are entered the data needed to record the liability in the voucher register; that is, the voucher must show what account or accounts are to be debited and in what amounts. It also shows the name of the person or company to whom payment is to be made. Spaces are provided in which to indicate that the required steps in the verification of the invoice have been performed and for signature of the person who authorizes the payment. Vouchers are either numbered as they are prepared or they may be prenumbered. Various other facts may also appear on the voucher as can be seen from the illustration in Figure *7a*. Many different voucher forms are in use, for they are designed to suit the preferences of each company. In order to save clerical work, the voucher and a check for payment of the liability are ordinarily prepared together. Thus, with the use of carbon copies, the name and address of the payee, the amount



№ 14763

THE BANK OF NEW YORK

Oct. 29, 19—

VOUCHER

$741.50

INVOICES PAID

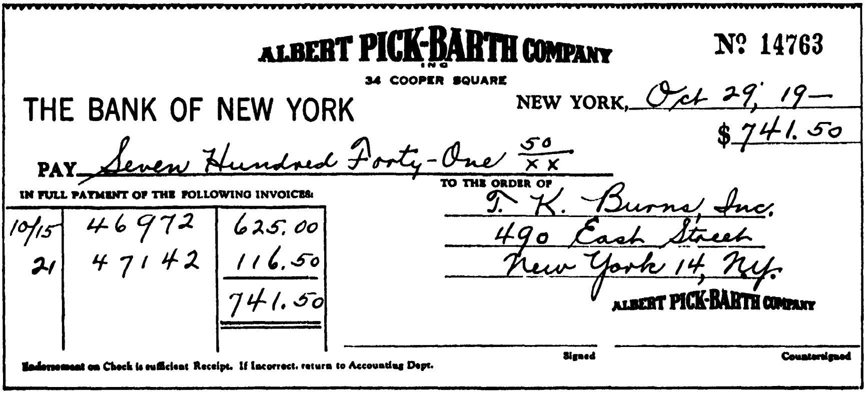
10/15	46972	625.00
21	47142	116.50
		741.50

DISTRIBUTION			REMITTANCE	
CHARGE ACCOUNT		AMOUNT	CREDIT	AMOUNT
NUMBER	NAME			
1501	Advertising	741.50	CHECK	741.50
			DISCOUNT	
			OTHER CREDITS	
			RETURNS	
			ALLOWANCES	
			TOTAL	741.50

APPROVED FOR PAYMENT

POSTED TO ACCOUNTS PAYABLE

Figure 7*a*. Voucher Prepared Simultaneously with Voucher Check



ALBERT PICK-BARTH COMPANY INC

34 COOPER SQUARE

№ 14763

THE BANK OF NEW YORK

NEW YORK, Oct 29, 19—

$741.50

PAY Seven Hundred Forty-One 50/xx

IN FULL PAYMENT OF THE FOLLOWING INVOICES:

10/15	46972	625.00
21	47142	116.50
		741.50

TO THE ORDER OF

T. K. Burns, Inc.
490 East Street
New York 14, N.Y.

ALBERT PICK-BARTH COMPANY

Signed

Countersigned

Endorsement on Check is sufficient Receipt. If Incorrect, return to Accounting Dept.

Figure 7*b*. Voucher Check

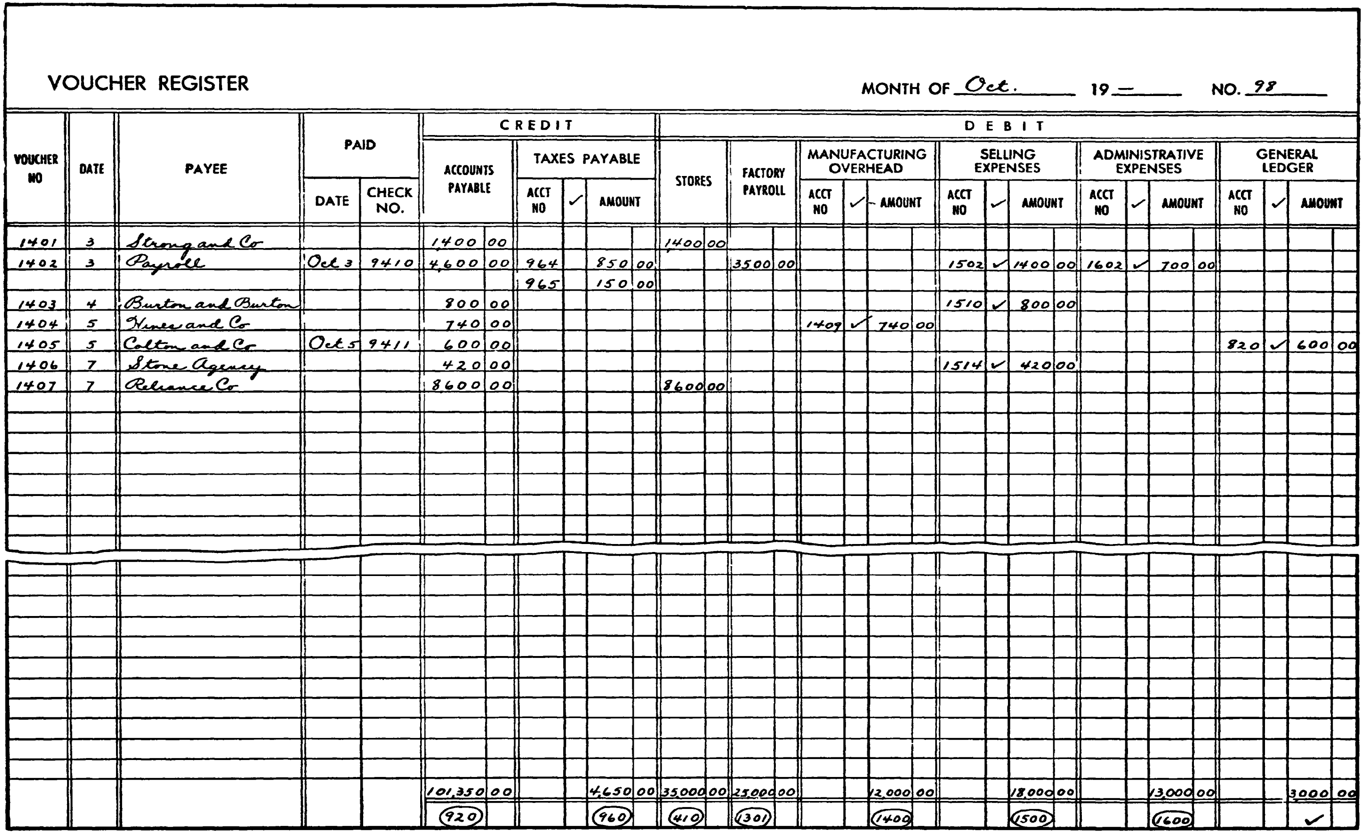
to be paid, and other facts can be typed on both check and voucher at the same time. The check is then called a voucher check. It often contains a box printed on the face of the check stating precisely what invoice or invoices are covered by the voucher. There is also a notation concerning indorsement (Figure *7b*).

Entry in Voucher Register. After the voucher has been prepared, audited, and approved it is entered in the voucher register. The voucher register is a book of original entry in which are recorded all current liabilities for which vouchers have been made up. There is no standardized form of voucher register. Usually it contains columns for such information as the date, name of the creditor, and voucher number. In addition columns must be provided in which to enter debits since various accounts must be debited according to the nature of the transaction. These are called distribution columns. A single credit column is usually sufficient since all credits are to Accounts Payable or Vouchers Payable. A typical voucher register is illustrated in Figure 8. The postings yielded by the voucher register at the end of each month are based on the following summary entry:

Stores	$ xx	
Factory Payroll	xx	
Manufacturing Overhead	xx	
Selling Expenses	xx	
Administrative Expenses	xx	
General Ledger	xx	
Accounts Payable		$ xx
Taxes Payable		xx

It should be stressed that the voucher register suggested in Figure 8 presupposes the existence of a system of coding for the various accounts and the use of controlling accounts and subsidiary ledgers for the various categories of expense. In this illustration the account Taxes Payable is a controlling account and subsidiary records are required for the various taxes withheld from employees in connection with the payment of salaries and wages, such as federal and state personal income taxes, old age benefits tax, unemployment compensation tax, and disability benefits tax. Other credit columns sometimes occur in the voucher register (e.g., for purchase discounts).

Payment of Vouchers. When the time for payment approaches, the voucher and accompanying check are sent to the treasurer in order that the check may be signed. The voucher serves to show that the disbursement is a proper one. After the signature is placed on the check, the check is sent to the creditor and the voucher is sent to the accounting department for entry in the check register.



VOUCHER REGISTER

MONTH OF Oct. 19— NO. 98

VOUCHER NO	DATE	PAYEE	PAID		CREDIT				DEBIT													
					ACCOUNTS PAYABLE	TAXES PAYABLE			STORES	FACTORY PAYROLL	MANUFACTURING OVERHEAD			SELLING EXPENSES			ADMINISTRATIVE EXPENSES			GENERAL LEDGER		
			DATE	CHECK NO.		ACCT NO	✓	AMOUNT			ACCT NO	✓	AMOUNT	ACCT NO	✓	AMOUNT	ACCT NO	✓	AMOUNT	ACCT NO	✓	AMOUNT
1401	3	Strong and Co			1400 00				1400 00													
1402	3	Payroll	Oct 3	9410	4,600 00	964		850 00		3500 00				1502	✓	1400 00	1602	✓	700 00			
						965		150 00														
1403	4	Burton and Burton			800 00									1510	✓	800 00						
1404	5	Hines and Co			740 00						1409	✓	740 00									
1405	5	Colton and Co	Oct 5	9411	600 00															820	✓	600 00
1406	7	Stone Agency			420 00									1514	✓	420 00						
1407	7	Reliance Co			8600 00				8600 00													
					101,350 00			4,650 00	35,000 00	25,000 00			12,000 00			18,000 00			13,000 00			3000 00
					(920)			(960)	(410)	(301)			(1400)			(1500)			(1600)			✓

FIGURE 8. Voucher Register

The Check Register. A check register is a type of cash disbursement journal which records checks drawn in payment of vouchers. The only money columns necessary are those for net cash, purchase discounts (unless found in the voucher register), and accounts payable. As the voucher checks are released they are entered in the check register as debits to Accounts Payable and credits to Cash in Bank. Purchase discounts received are entered in the credit column provided for this purpose. At the same time the check is entered in the check register a notation of the check number and the date of payment is made in the "Paid" column of the voucher register.

Short Cuts in Voucher System. Various attempts have been made to incorporate labor-saving features in connection with the operation of the voucher register and related books. In general, the efforts have been directed along two lines:

1. The accumulation of several invoices from the same supplier on a single voucher
2. The simultaneous preparation of all documents and entries in connection with the vouchering and payment of an invoice

Accumulation of Invoices. A fairly common method of labor saving is to accumulate as many invoices as possible from a given supplier on a single voucher (Figures *7a* and *7b*). Figure *7b* is the check; it is hinged to Figure *7a* by perforations, and when folded over, it completely covers the upper part of the voucher. A carbon of the same size as the check is inserted between the check and the voucher. When an invoice has been audited, the name and address of the creditor or payee are typed in, and the details of the invoice recorded in the proper space on the check. All these documents are then filed away in a *voucher jacket.* The latter, in effect, is nothing but a folder, one for each creditor, in which are accumulated the invoices for that creditor. In its more elaborate form the voucher jacket may contain printed spaces for summarizing the invoices filed within it. If during the course of the month additional invoices are received and audited from the same creditor, the check and voucher are taken out of the folder, and the additional invoice typed in the invoice space. At the end of the month, or whenever time for payment is at hand, the invoices recorded on the check are totaled, amount and date typed in, and submitted for approval. The original, after approval, is detached, recorded in the check register, and mailed to the payee. The duplicate which serves as a voucher is analyzed as to accounts to be charged in the space provided therefor and entered in the voucher register.

Where the above system is in use it is customary for the debtor to try to arrange with the creditors for payments to be made once a month with permission to take all discounts that would have been available to the debtor if the invoices were paid strictly within the stated discount period. Ordinarily no difficulties are experienced on this score but where such an arrangement cannot be made, care must be exercised to arrange for vouchering of the invoices within the discount period. This, of course, may cut down the possibility of combining more than one invoice on a single voucher.

Simultaneous Preparation of Related Documents. Another form of labor saving consists of preparing in a single writing all the documents necessary to record and liquidate the liability in question. These documents include the voucher, distribution ticket or tickets, voucher register, check to supplier, remittance advice to supplier, and the check register.

It is possible by designing the above forms properly to prepare all the necessary records in a single writing, usually on a specially designed typewriter. This would mean that each invoice must be separately vouchered. However, as can be seen from the list above, the labor-saving feature arises from the fact that all the entries are made at one time. The system, of course, has the further advantage of obviating errors of transcription. Some duplication of information is necessary on all of the above documents, such as voucher number, name and address of supplier, and amount. By preparing all the documents in a single writing the chances for errors of transcription are greatly lessened.[1]

Under this system a separate check register is not really necessary. By preparing an extra copy of the voucher, the latter may be kept in a separate binder which may thus serve as a check register.

Filing Paid Vouchers. After payment has been made, the vouchers are filed in numerical or alphabetical order, the supporting documents (creditors' invoices, payrolls, etc.) being attached to the respective vouchers. Some companies also attach the canceled checks to the voucher after the checks have been returned by the bank. Thus the voucher and its supporting documents provide the source information which the auditor requires in order to verify the company's analysis of the transaction.

Sometimes a special form of voucher jacket known as a voucher backer (Figure 9) is used for the above purpose. In such cases much of the information ordinarily contained on the voucher for auditing purposes is shown on the voucher backer.

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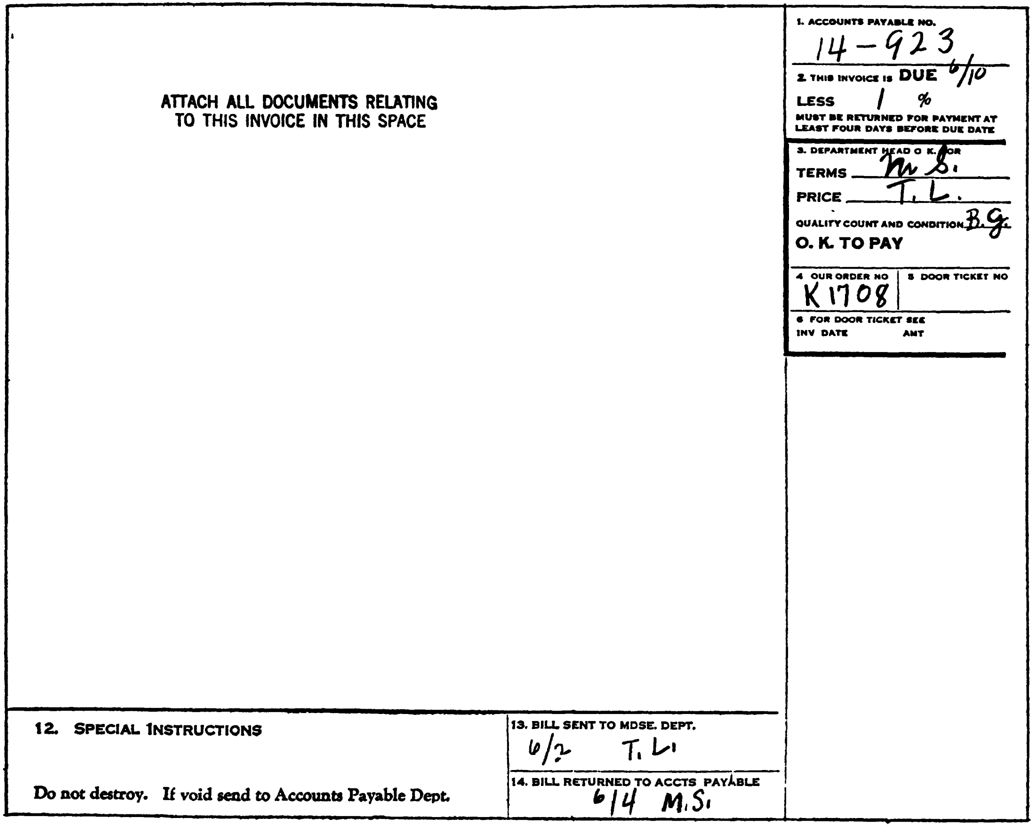
[1] The details in operating such a system are described by William T. Collins, "Methods Study Applied to an Accounts Payable System," *N.A.C.A. Bulletin*, January 15, 1942, pp. 654 ff. See also Theodore Lang (ed.), *Cost Accountants' Handbook* (New York: The Ronald Press Co., 1944), pp. 260-65.



ATTACH ALL DOCUMENTS RELATING
TO THIS INVOICE IN THIS SPACE

1. ACCOUNTS PAYABLE NO. 14-923

2. THIS INVOICE IS DUE 6/10

LESS 1 %

MUST BE RETURNED FOR PAYMENT AT LEAST FOUR DAYS BEFORE DUE DATE

3. DEPARTMENT HEAD O. K. FOR

TERMS M. S.

PRICE T. L.

QUALITY COUNT AND CONDITION B. G.

O. K. TO PAY

4 OUR ORDER NO	5 DOOR TICKET NO
K1708	

6 FOR DOOR TICKET SEE
INV DATE AMT

12. SPECIAL INSTRUCTIONS

Do not destroy. If void send to Accounts Payable Dept.

13. BILL SENT TO MDSE. DEPT. 6/2 T. L.

14. BILL RETURNED TO ACCTS PAYABLE 6/4 M. S.

FIGURE 9. Voucher Backer

Creditors' Index File. Since no creditors' ledger is kept under the voucher system, the company has in no single place a complete record of all transactions with a given creditor. A specific transaction can be located by searching through the voucher register and numerical voucher file until the desired voucher is located, but this is a slow and inconvenient procedure. Hence it is desirable to keep an alphabetical creditors' index file. This may consist of cards, one for each creditor, on which are shown the creditor's name and address, the voucher number, the date; the amount, and the date of payment. Postings to these cards are made from the vouchers. An alternative method is to make duplicate copies of the vouchers and to file these duplicates alphabetically. By using this alphabetical file, the record of all transactions with any specific creditor can be quickly located.

The drawbacks to this index are twofold: (1) it at once does away with any possible savings occasioned by the absence of a creditors' ledger and (2) there is no guaranty of the mathematical accuracy of the file, such as can be had when the Accounts Payable controlling account is kept in exact balance with the subsidiary ledger.

Special Problems in Use of Voucher Register. The voucher system operates most satisfactorily when payments are made promptly, in full, and when returns and allowances are not numerous. Special treatment is required for purchase discounts, partial payments, returns and allowances, payments by notes and drafts, account distribution, and unaudited vouchers.

Purchase Discounts. A company in a sufficiently strong financial position ordinarily pays all bills within the discount period as a matter of financial policy. There are three ways of handling the purchase discounts on the books. These are illustrated in comparative form in Figure 10. Under the first method the gross invoice price is entered in the voucher register and the discount is reported as earned at time of payment. The second method differs from the first in that the purchase discount is considered earned at the time the invoice is entered. If payment of the bill is delayed beyond the discount period, the earned discount must be canceled or a new account introduced in the form of Purchase Discounts Lost [Entry (2c)]. Under the third method the invoice is recorded net. No earned discount is therefore shown on the books. If the bill is not paid on time, it is necessary to raise a special account, Purchase Discounts Lost, on the books [Entry (3c)].

The first method is probably the most common. However, it gives information only as to the discounts taken and is silent on the missed opportunities, that is, on the discounts forfeited. Under Method 2 all relevant information is shown since both the discounts taken and those missed are reflected in the operating statement. Method 3 represents the procedure recommended by the Controllers' Institute. It considers the discount offered as a price reduction which is not the case under the other two methods; it also sets up a specific expense account to record failure to take discounts. This is a much more significant figure than the figure concerning discounts earned.

From a procedural point of view, Method 1 requires a credit column for purchase discounts earned in the check register. Method 2 makes it necessary to move this column to the voucher register. However, a *debit* column for purchase discounts lost is also necessary in the check register. The same is true of Method 3, which, however, requires no earned discount column in any record.

Partial Payments. If it is known in advance that partial payments are to be made for a given invoice, a separate voucher is prepared for the amount of each payment. If, however, the full amount of the liability has already been entered in the voucher register, the original voucher is canceled and two new vouchers issued in its place. The first new voucher is for the current payment, the second for the unpaid balance. Cancellation of the original voucher is shown in the voucher register by writing in the "Paid" column the date and the word "canceled" and referring to the new voucher numbers. The new vouchers are of course debited and credited to Accounts Payable. If partial payments become at all extensive, it is best to use the voucher register as a *purchase journal,* supported by a creditors' ledger. The other features of the voucher system may of course be retained.

Payments by Notes. Payment of a voucher by a promissory note is recorded in the general journal:

Vouchers Payable	$950.00	
Notes Payable		$950.00

The liquidation column in the voucher register must be made to show

1. Date of payment
2. Number of the note
3. Page number of journal where the entry occurs

At maturity of the note, a new voucher must be drawn to liquidate Notes Payable. Expressed in journal form, the entry is as follows:

Notes Payable	$	
Vouchers Payable		$ . . .

Thereafter the voucher follows the usual channels.

	Invoice Is Received			Payment Within Discount Period			Payment After Discount Period		
Method 1	(1a)			(1b)			(1c)		
	Stores	$1,000.00		Accounts Payable	$1,000.00		Accounts Payable	$1,000.00	
	Accounts Payable		$1,000.00	Cash		$ 980.00	Cash		$1,000.00
				Purchase Discounts		20.00			
Method 2	(2a)			(2b)			(2c)		
	Stores	$1,000.00		Accounts Payable	$ 980.00		Accounts Payable	$ 980.00	
	Accounts Payable		$ 980.00	Cash		$ 980.00	Purchase Discounts Lost	20.00	
	Purchase Discount		20.00				Cash		$1,000.00
Method 3	(3a)			(3b)			(3c)		
	Stores	$ 980.00		Accounts Payable	$ 980.00		Accounts Payable	$ 980.00	
	Accounts Payable		$ 980.00	Cash		$ 980.00	Purchase Discounts Lost	20.00	
							Cash		$1,000.00

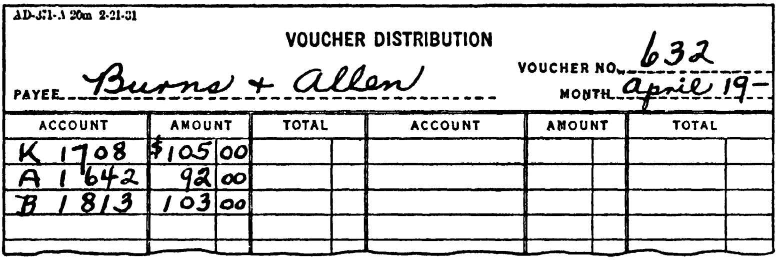
FIGURE 10. Different Methods for Handling Purchase Discounts

Returns and Allowances. Defects in the quality of goods received, errors in pricing, etc., do not affect, as a rule, the books of account, since most of these items are revealed in the process of auditing before vouchering and entry in the books. Where, however, entries have been made and it becomes necessary to return goods to a supplier or ask for an allowance, this is evidenced by receipt of a credit memo from the supplier or issuance of a voucher charge by the purchaser. The latter is similar to a voucher but of a different color and is entered in the voucher register in red ink, thus reversing debits and credits. A copy of the voucher charge is attached to the original voucher to prevent overpayment. A statement may appear on the voucher charge informing the supplier that it is unnecessary to issue a credit memo.

Another method is to cancel the original voucher and issue a new one for the reduced amount. The entry is as follows:

Vouchers Payable (No. 62)	$575.00	
Vouchers Payable (No. 89)		$540.00
Stores (or other account)		35.00

The debit appears in the Sundries column, the credit to Vouchers Payable in the usual column, and the credit to Stores or other account in red ink in the appropriate distribution column. If the invoice in question has already been paid, the voucher charge may be attached to the next invoice or it will be liquidated by the receipt of a check from the supplier.



AD-371-A 20m 2-21-31

VOUCHER DISTRIBUTION

PAYEE Burns + Allen

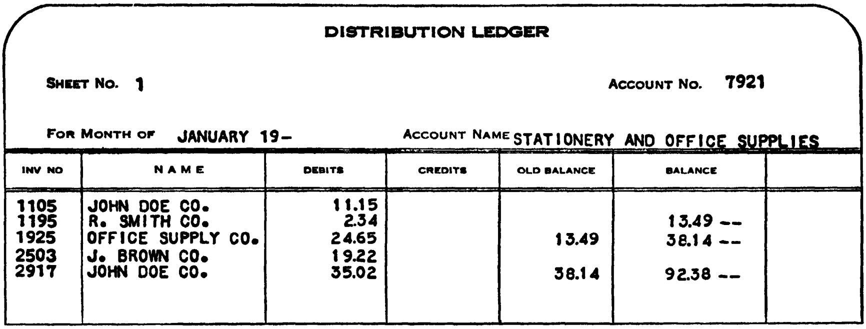
VOUCHER NO. 632

MONTH April 19—

ACCOUNT	AMOUNT		TOTAL		ACCOUNT	AMOUNT		TOTAL	
K 1708	$105	00							
A 1642	92	00							
B 1813	103	00							

Figure 11. Voucher Distribution Sheet

Account Distribution. If often happens that many accounts are to be charged from a single voucher, thus making the voucher register unwieldy by introducing too many columns. This is sometimes overcome by the introduction of a separate voucher distribution form (Figure 11). Postings are then made to a distribution ledger (Figure 12). A separate distribution ledger card is used for each expense or other account to which a distribution is made. These cards thus reflect a detailed analysis for postings to each account.



DISTRIBUTION LEDGER

SHEET NO. 1 ACCOUNT NO. 7921

FOR MONTH OF JANUARY 19– ACCOUNT NAME STATIONERY AND OFFICE SUPPLIES

INV NO	NAME	DEBITS	CREDITS	OLD BALANCE	BALANCE	
1105	JOHN DOE CO.	11.15				
1195	R. SMITH CO.	2.34			13.49 --	
1925	OFFICE SUPPLY CO.	24.65		13.49	38.14 --	
2503	J. BROWN CO.	19.22				
2917	JOHN DOE CO.	35.02		38.14	92.38 --	

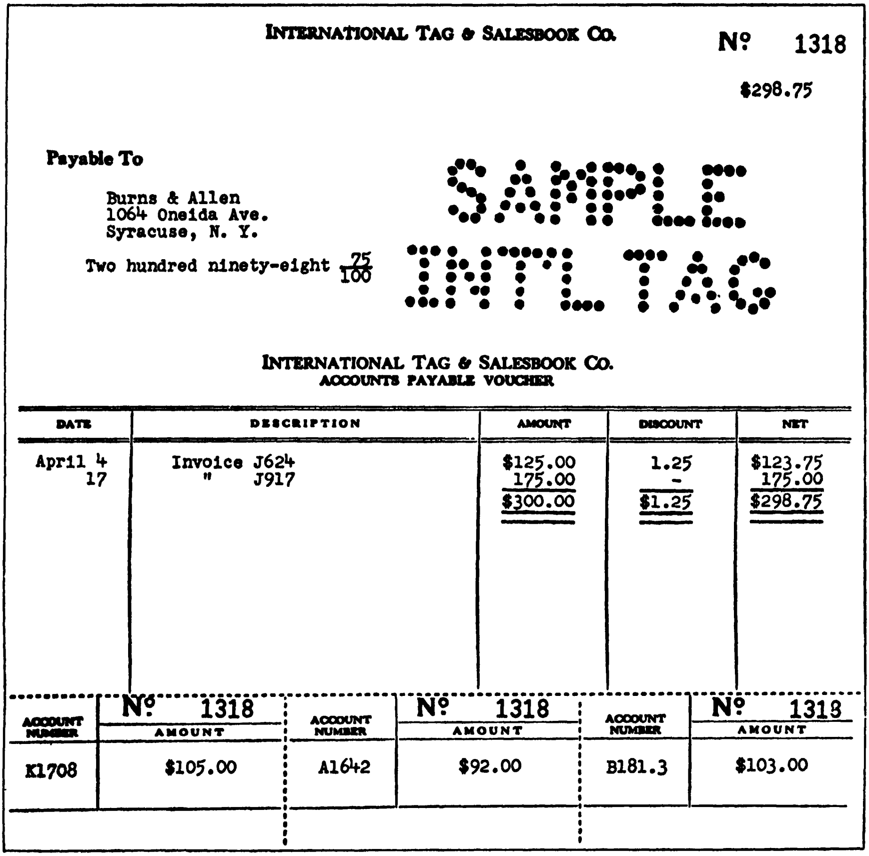
FIGURE 12. Distribution Ledger

Another variation of this system for obtaining account distributions is through the use of unit distribution tickets. Where this system is used, the voucher has a series of tickets with perforated sides attached to it. These tickets all bear the same number as the voucher and contain spaces for inserting the account number and amount (Figure 13). At time of entering the voucher in the voucher register, the distribution tickets are detached, sorted by account numbers, and posted.

Unaudited Vouchers. At all times there are many purchase invoices which have not been completely audited, and are therefore not as yet entered in the voucher register. Since most concerns keep their books on an accrual basis, it is necessary to summarize all such items and make an adjusting entry by debiting various inventory and expense accounts and crediting some such account as Sundry Liabilities or Unaudited Accounts Payable. After the books are closed, this entry is reversed, and thereafter invoices are put through their normal procedure.

Journal Vouchers. The voucher plan is widely applied to journal entries as well as to entries which are made in the voucher register. Thus every journal entry requires preparation of a journal voucher which is an authorization to make an entry in a journal. No entry may be made in a journal except on the authority of a properly approved journal voucher. While the form of journal vouchers is not standardized, they show the entry to be made; initials or names of persons who prepared, approved, and entered it; and the ledger to which posting is to be made (Figure 14). In practice, a journal is often a file of journal vouchers rather than a bound or columnar book. Postings to the appropriate ledger may be made directly from the journal vouchers.

Separate journals for important classes of transactions, such as material issues and payrolls, may be kept by filing together all vouchers covering material issues and all vouchers for payroll entries. Ordinarily



INTERNATIONAL TAG & SALESBOOK CO. № 1318

$298.75

Payable To

Burns & Allen
1064 Oneida Ave.
Syracuse, N. Y.

Two hundred ninety-eight $\frac{75}{100}$

SAMPLE
INT'L TAG

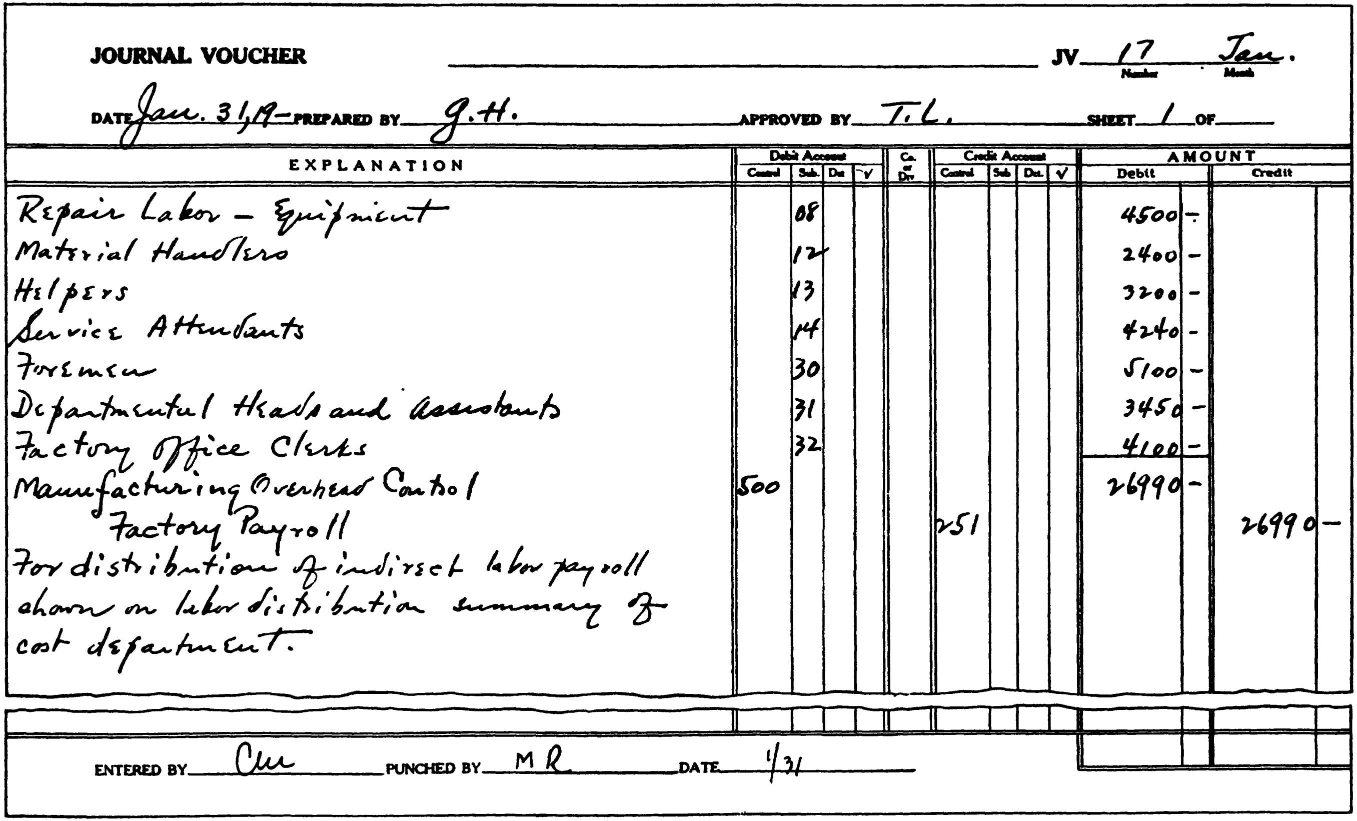
INTERNATIONAL TAG & SALESBOOK CO.
ACCOUNTS PAYABLE VOUCHER

DATE	DESCRIPTION	AMOUNT	DISCOUNT	NET
April 4	Invoice J624	$125.00	1.25	$123.75
17	" J917	175.00	-	175.00
		$300.00	$1.25	$298.75

ACCOUNT NUMBER	№ 1318 AMOUNT	ACCOUNT NUMBER	№ 1318 AMOUNT	ACCOUNT NUMBER	№ 1318 AMOUNT
K1708	$105.00	A1642	$92.00	B181.3	$103.00

FIGURE 13. Voucher with Distribution Tickets Attached

a journal voucher is not prepared for every individual transaction when there are a great many transactions of the same type. Thus there may be hundreds or even thousands of material issues each month, and to make individual entries for each would require a wholly unnecessary amount of clerical work. Hence the transactions are summarized monthly and a single journal voucher prepared to cover all transactions that occurred during the period. Again, using material issues as an illustration, all material issues are debits to either Material in Process or to Manufacturing Overhead accounts and credits to Stores. The material requisitions presented to the storeskeeper can be tabulated and a single journal voucher prepared for entry in the appropriate controlling accounts. It is, of course, necessary to make individual postings to the subsidiary materials ledger, but these postings can be made directly from the original requisitions.



JOURNAL VOUCHER JV 17 (Number) Jan. (Month)

DATE Jan. 31, 19— PREPARED BY G. H. APPROVED BY T. L. SHEET 1 OF

EXPLANATION	Debit Account				Co. or Div.	Credit Account				AMOUNT	
	Control	Sub.	Dst.	√		Control	Sub	Dst.	√	Debit	Credit
Repair Labor — Equipment		08								4500 —	
Material Handlers		12								2400 —	
Helpers		13								3200 —	
Service Attendants		14								4240 —	
Foremen		30								5100 —	
Departmental Heads and Assistants		31								3450 —	
Factory Office Clerks		32								4100 —	
Manufacturing Overhead Control	500									26990 —	
Factory Payroll						251					26990 —
For distribution of indirect labor payroll shown on labor distribution summary of cost department.											

ENTERED BY Cm PUNCHED BY M R DATE 1/31

FIGURE 14. Journal Voucher

The Factory Ledger

Disadvantages of Keeping Cost Accounts in General Ledger. Thus far it has been assumed that all accounts are kept in a single ledger. The small factory generally follows this practice. However, as the business grows, several disadvantages become apparent:

1. The number of accounts in the general ledger becomes inconveniently large.
2. Preparation of the monthly statements may be delayed since all figures must go through one ledger to appear eventually in the trial balance. When the office and the factory are located in different places, the general office cannot close its books until the factory reports are received. The ensuing monthly statements may be so delayed as to lose a great deal of their value as indices of current conditions.
3. In large organizations with several factories it is common for the management of each plant to have a large degree of autonomy. A complete set of accounts is needed at each plant in order that the management of the plant may have information it needs to operate most efficiently.
4. It may be desired not to entrust too much information to one person. A division of labor permits different persons to work independently on specific accounts which are kept under unified control through interlocking accounts.

When the above conditions arise, the cost accounts are removed from the general ledger and set up in a separate ledger called the *factory ledger*. This ledger may be kept at the manufacturing plant while the general ledger is kept at the main office of the company.

When the cost accounts are thus separated from the general ledger, it is necessary to compensate the general ledger for the accounts removed from it by introducing a new account named "Factory Ledger." In the same way an account called "General Ledger" is introduced into the factory ledger. These two accounts are sometimes called reciprocal accounts because both accounts are affected by the same transactions, but in an opposite manner. They are also called interlocking accounts since the two ledgers are tied together and kept in agreement through use of these accounts.

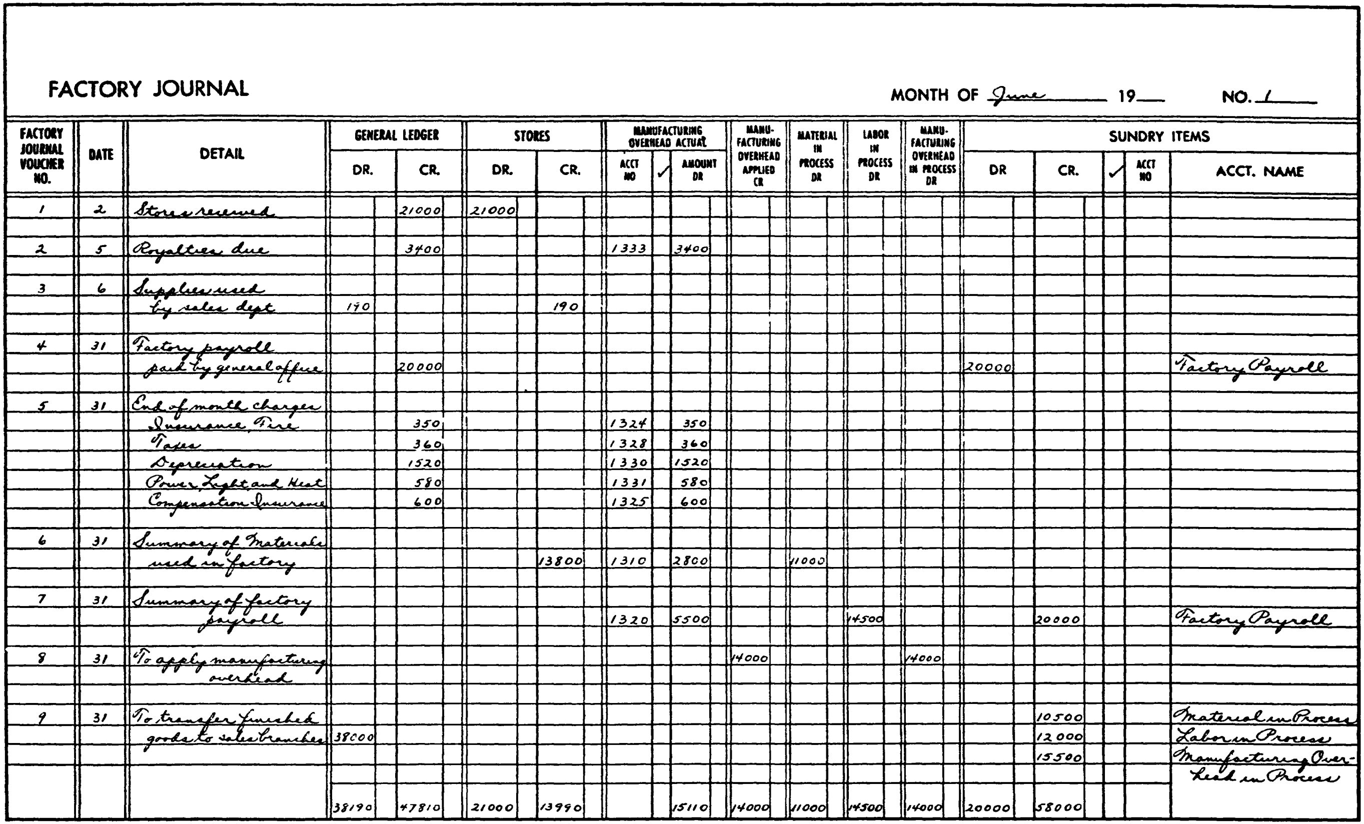
Opening the Factory Ledger. When opening the factory ledger, accounts for manufacturing costs are transferred from the general ledger to the factory ledger. Assuming that a loose-leaf ledger is in use, the sheets on which the cost accounts appear may simply be removed from the binder and inserted in a new binder to be used as a factory ledger. In place of the accounts removed from the general ledger a new ledger sheet headed Factory Ledger is inserted. An additional sheet for the General Ledger account is also inserted in the new factory ledger. These changes should be accompanied by proper journal entries which are shown in the illustration on pages 82-83. An additional journal called the factory journal will be needed for original entry of transactions to be posted to the factory ledger.

Factory Journals. A factory journal is used as a book of original entry for transactions which are to be posted to accounts in the factory ledger. The factory journal may be a simple two-column journal, it may be a multicolumn record, or it may be a loose-leaf file of sheets on which entries are written. A columnar factory journal is illustrated in Figure 15. The purpose of the columns is to collect totals where there are many entries affecting certain accounts. The number of individual postings is thereby substantially reduced. It will be noted that a column is provided for entries in the General Ledger reciprocal account.

In present-day industrial accounting, journals are often summary sheets of transactions rather than columnar records. This development is a by-product of the widespread use of various types of accounting machines for bookkeeping purposes.

Transfer Vouchers. When an entry affects the interlocking accounts which tie together the general and factory ledgers, it is necessary to enter the same transaction in both ledgers. A transfer voucher is a special journal voucher which is used to transfer information needed to make such entries from the general office to the factory office or vice versa.

To illustrate, property taxes on land, buildings, and equipment may be paid by the general office. The transaction represents a debit to Manufacturing Overhead and a credit to Cash. However, since the cash account is in the general ledger, it is necessary to transfer to the factory office a notice of the debit to Manufacturing Overhead which is in the factory ledger. This information is entered on a transfer voucher and the voucher sent to the factory. This voucher authorizes the factory bookkeeper to debit Manufacturing Overhead and to credit the General Ledger. At the same time the entry on the general books calls for a debit to Factory Ledger and a credit to Cash. In this way all facts are entered in the accounting records. It is essential, of course, that the debit balance in the Factory Ledger and the credit balance in the General Ledger accounts be at all times in exact agreement.



FACTORY JOURNAL

MONTH OF June 19__ NO. 1

FACTORY JOURNAL VOUCHER NO.	DATE	DETAIL	GENERAL LEDGER		STORES		MANUFACTURING OVERHEAD ACTUAL			MANU-FACTURING OVERHEAD APPLIED CR	MATERIAL IN PROCESS DR	LABOR IN PROCESS DR	MANU-FACTURING OVERHEAD IN PROCESS DR	SUNDRY ITEMS				
			DR.	CR.	DR.	CR.	ACCT NO	✓	AMOUNT DR					DR	CR.	✓	ACCT NO	ACCT. NAME
1	2	Stores received		21000	21000													
2	5	Royalties due		3400			1333		3400									
3	6	Supplies used																
		by sales dept	190			190												
4	31	Factory payroll																
		paid by general office		20000										20000				Factory Payroll
5	31	End of month charges																
		Insurance, Fire		350			1324		350									
		Taxes		360			1328		360									
		Depreciation		1520			1330		1520									
		Power, Light and Heat		580			1331		580									
		Compensation Insurance		600			1325		600									
6	31	Summary of Materials																
		used in factory				13800	1310		2800		11000							
7	31	Summary of factory																
		payroll					1320		5500			14500			20000			Factory Payroll
8	31	To apply manufacturing								14000			14000					
		overhead																
9	31	To transfer finished													10500			Material in Process
		goods to sales branches	38000												12000			Labor in Process
															15500			Manufacturing Over-head in Process
			38190	47810	21000	13990			15110	14000	11000	14500	14000	20000	58000			

FIGURE 15. Factory Journal

Factory Ledger Illustration

Opening the Factory Ledger. If it is decided to establish a factory ledger at the beginning of a fiscal year, that is, immediately after the books have been closed for the previous year, the following steps are taken:

1. From the trial balance taken after closing, select the cost accounts. These accounts are marked with an asterisk on the trial balance below.

TRIAL BALANCE

Cash	$ 15,000.00	
Prepaid Insurance	5,000.00	
Accounts Receivable	25,000.00	
*Stores	50,000.00	
*Material in Process	15,000.00	
*Labor in Process	15,000.00	
*Manufacturing Overhead in Process	15,000.00	
*Finished Goods	60,000.00	
Plant and Equipment	200,000.00	
Accrued Payroll		$ 5,000.00
Capital Stock		360,000.00
Surplus		35,000.00
	$400,000.00	$400,000.00

2. Transfer these accounts to the factory ledger. Record this transfer by making an entry in the general journal and posting to the general ledger [Entry (1a)].

3. Record the opening of the factory ledger with an entry in the factory journal. Post to the factory ledger [Entry (1b)].

Both sets of books are now ready for current transactions.

4. From the chart of accounts, select the cost accounts not yet appearing in the factory ledger. In this limited illustration, these will include Factory Payroll and Manufacturing Overhead.[2] These accounts do not appear in the preceding trial balance because they contained no balances after closing. Open an account in the factory ledger for each of these accounts.

5. Record transactions in the general and factory books as necessary.

Operation of the Factory Ledger. As manufacturing costs are incurred, they are entered in the factory books. Assume that during the first month after establishment of the factory ledger the following costs are incurred:

Labor: direct, $20,000; indirect, $10,000
Materials issued: direct, $20,000; indirect, $5,000

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[2] Some accountants also include Cost of Sales in the factory ledger, but it is generally more convenient to keep it in the general ledger.

The above transactions, shown in Entries (3) and (4), affected only accounts on the factory ledger. Hence recording in the factory books only was necessary. While the use of direct and indirect labor affected accounts in the factory ledger, [Entry (2b)], the accrual of these wages and salaries affects general ledger accounts and is therefore reflected on these records [Entry (2a)]. Other transactions may affect accounts in both factory and general ledgers. These transactions must be entered in both sets of books. Thus factory plant and equipment is shown in the general ledger. However, depreciation, insurance, and taxes on these assets are manufacturing costs and since the manufacturing accounts are represented in the general ledger only by the Factory Ledger account, the latter account is debited, the corresponding credits being Allowance for Depreciation, Prepaid Insurance, and Taxes Accrued. These are all posted in the general ledger [Entry (5a)]. In order that the cost accounts on the factory books may show all of the costs of manufacturing, a transfer voucher covering the above facts is sent to the factory accountant who then makes an entry in the factory journal and posts it to the factory ledger [Entry (5b)].

After all the manufacturing overhead has been entered on the factory books, the Manufacturing Overhead account is cleared to Work in Process by an entry in the factory journal [Entry (6)]. No entry in the general ledger is required to record completed work, since both the debit and credit are represented in the factory ledger only. The fact that goods have been moved from the factory to the warehouse makes no change in the net assets which are held by the factory and which are represented by the debit balance in the Factory Ledger account on the general ledger. Also no change has been made in the balance of the General Ledger account on the factory ledger.

If products costing $75,000 are completed and transferred to Finished Goods, the only entry required is in the factory journal [Entry (7)].

Assuming that goods costing $45,000 are sold for $65,000, entries are again required in both ledgers, for any transaction which affects one of the two reciprocal accounts has an equal but opposite effect on the other reciprocal account [Entries (8a) and (b) and (9)].

Closing the Books. The factory ledger must be balanced at the end of each month and a copy of the trial balance sent to the main office. Information appearing in the factory ledger trial balance is necessary in the preparation of monthly financial statements for the company. In doing this, the accounts appearing in the two ledgers are consolidated in order that a single balance sheet and income statement can be prepared. The process of consolidation is accomplished on a work sheet as shown in Figure 16. It will be noted that the two reciprocal accounts drop out in the process of consolidation.

WORK SHEET CONSOLIDATING GENERAL AND FACTORY LEDGERS

DECEMBER 31, 19—

	General Ledger Trial Balance		Factory Ledger Trial Balance		Eliminations		Combined Trial Balance	
	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.	Dr.	Cr.
Cash	$ 15,000.00						$ 15,000.00	
Accounts Receivable	90,000.00						90,000.00	
Stores			$ 25,000.00				25,000.00	
Material in Process			10,000.00				10,000 00	
Labor in Process			10,000.00				10,000.00	
Manufacturing Overhead in Process			10,000.00				10,000.00	
Finished Goods			90,000.00				90,000.00	
Prepaid Insurance	4,000.00						4,000.00	
Plant and Equipment	200,000.00						200,000.00	
Allowance for Depreciation		$ 2,000.00						$ 2,000.00
Cost of Sales	45,000.00						45,000.00	
Factory Ledger	145,000.00					$145,000.00		
Accrued Taxes		2,000.00						2,000.00
Accrued Payroll		35,000.00						35,000.00
General Ledger				$145,000.00	$145,000.00			
Sales		65,000.00						65,000.00
Capital Stock		360,000.00						360,000.00
Surplus		35,000.00						35,000.00
	$499,000.00	$499,000.00	$145,000.00	$145,000.00	$145,000.00	$145,000.00	$499,000.00	$499,000.00

FIGURE 16. Work Sheet Showing Consolidation of General and Factory Ledger Trial Balances

ENTRIES IN GENERAL JOURNAL

(Affecting General Ledger)

(1a)

Factory Ledger	$155,000.00	
Stores		$50,000.00
Material in Process		15,000.00
Labor in Process		15,000.00
Manufacturing Overhead in Process		15,000.00
Finished Goods		60,000.00

To transfer above accounts to factory ledger.

(2a)

Factory Ledger	$ 30,000.00	
Accrued Payroll		$30,000.00

For factory payroll for month.

(5a)

Factory Ledger	$ 5,000.00	
Allowance for Depreciation		$ 2,000.00
Prepaid Insurance		1,000.00
Accrued Taxes		2,000.00

For depreciation, insurance, and tax on factory assets.

(8a)

Cost of Sales	$ 45,000.00	
Factory Ledger		$ 45,000.00

To charge cost of sales for cost of finished goods sold.

(9)

Accounts Receivable	$ 65,000.00	
Sales		$65,000.00

For sales for current period.

ENTRIES IN FACTORY JOURNAL

(Affecting Factory Ledger)

(1b)

Stores	$50,000.00	
Materials in Process	15,000.00	
Labor in Process	15,000.00	
Manufacturing Overhead in Process	15,000.00	
Finished Goods	60,000.00	
General Ledger		$155,000.00

To set up factory ledger.

(2b)

Factory Payroll	$30,000.00	
General Ledger		$ 30,000.00

For factory payroll for month.

(3)

Labor in Process	$20,000.00	
Manufacturing Overhead	10,000.00	
Factory Payroll		$ 30,000.00

To close payroll for direct and indirect labor.

(4)

Material in Process	$20,000.00	
Manufacturing Overhead	5,000.00	
Stores		$ 25,000.00

To charge for direct and indirect materials used.

(5b)

Manufacturing Overhead	$ 5,000.00	
General Ledger		$ 5,000.00

For other manufacturing expense.

(6)

Manufacturing Overhead in Process	$20,000.00	
Manufacturing Overhead		$ 20,000.00

To cost overhead to work in process.

(7)

Finished Goods	$75,000.00	
Material in Process		$ 25,000 00
Labor in Process		25,000.00
Manufacturing Overhead in Process		25,000.00

To transfer goods finished during period.

(8b)

General Ledger	$45,000.00	
Finished Goods		$ 45,000.00

For finished goods sold.

QUESTIONS

1. List the elements of internal check generally associated with a voucher system.
2. What books of account are replaced or simplified by use of a voucher register?
3. How would you verify an end of month balance of $48,169.07 in the vouchers payable account in the general ledger?
4. Explain how a purchase return and allowance account may be provided for under a voucher system.
5. Compare a production order with a betterment order as to purpose and ultimate accounting treatment.
6. In a certain business an item purchased on December 27 cost $3,000, terms 1/10 net 30. The books are closed on December 31 and the bill was paid on January 5 of the following year. The net profit for the year of purchase without considering this transaction is $20,000 and for the next year $31,000.

   Considering the *methods* outlined for handling purchase discount, answer the following questions:

   a) What amount would be charged to purchases?
   b) If the goods were sold in the year of purchase, how would the profit of the year be affected?
   c) What profits would be reported for the year of payment?
7. List the advantages resulting from the use of journal vouchers.
8. What basic principle of management is inherent in the accountant's extended use of special journals and ledgers?
9. Where cost accounts are kept in a factory ledger, list the type of cost transactions originating in the general office that must be reported to the factory office.
10. How do factory ledgers aid in control in a corporation operating factories located in different parts of the country?

Chapter 5

COST CLASSIFICATIONS

Need for Classification of Costs. In the process of cost accounting, costs are arranged and rearranged in various classifications, each of which helps to answer some of the questions frequently asked about costs. The same costs thus appear in several different classifications, depending on the purposes which the costs are to serve. For different purposes different kinds of information are required. Hence, costs must be so arranged and classified that they can be combined in different ways to serve different purposes.

Principal Cost Classifications. The principal bases of cost classification used by the cost accountant are:

1. Accounting period to which costs apply
2. By nature of item or service acquired; i.e., by object of expenditure
3. By functions
4. By behavior
5. Time when costs are computed

Accounting Period to Which Costs Apply. The question of the proper period which is to absorb a given cost raises the familiar problem of capital and revenue charges. More particularly, the costs deducted from revenues to compute a given year's profit must be limited to the costs which were incurred to earn the sales income of the same year. Thus the determination of profits is concerned with allocating costs to the periods to which they apply. This is accomplished by classifying the costs as charges to asset accounts or as charges to expense accounts. Expense accounts may therefore be referred to as *period* charges, since they are carried to profit and loss each period. They measure the costs of obtaining the revenue of the period (Figure 17).

Expenditures are made to acquire benefits which are expected to result in future revenue to the business. These are classified as assets. They are said to be capitalized. The capitalization may take two forms (Figure 17):

1. Costs for material, labor, and manufacturing overhead may be capitalized in inventories. In such cases the costs are referred to as product costs.
2. Expenditures may be made to acquire fixed assets, including land, buildings, machinery, machine tools, and fixtures.

Object of Expenditure. In recording costs, the accountant first groups them according to what item or service was acquired. Examples of such a classification are accounts for salaries and wages, fuel, shop supplies, telephone and telegraph, depreciation, insurance and repairs. The degree of subdivision depends entirely on the extent of detailed information required. Thus in one company there may be only one account for insurance, while in another company separate accounts may be provided for fire insurance, use and occupancy insurance, and burglary. The accounts contained in this type of classification are often referred to as primary charges.

- Period Charges (Profit and Loss) . . Costs and Expenses
    - Manufacturing Cost of Sales
    - Selling Expense
    - Administrative Expense
    - Financial Management Expense
- Capitalized Charges . . Assets
    - Product Costs (Material, Labor, Overhead)
        - Work in Process Inventories
        - Finished Goods
    - Fixed Assets
        - Land
        - Buildings
        - Machinery and Equipment

FIGURE 17. Cost Classifications on Basis of Periods to Which They Apply

Closely allied to this type of analysis is classification by cost elements. The items and services used in production are commonly grouped into three classes called the elements of cost. These are direct materials, direct labor, and manufacturing overhead. Material cost is the cost of the substances of which the product is made (e.g., a book is made of paper, a pocket knife is made of steel) or substances consumed in making the product even though they do not appear in the final product (e.g., sandpaper used in furniture finishing). Labor cost is the cost of human effort and time employed in the production process. Manufacturing overhead comprises all other charges incurred in production.

Functional Classification. Costs are often classified according to the major divisions carried on within a manufacturing business and also by departments within each division. Costs classified on this basis are called functional costs. It is important to note that a functional classification takes primary charges and breaks them up according to a desired classification by divisions, departments, etc. The major functions are manufacturing, selling, administrative, and financial. These are the most familiar ones, since they follow the conventional subdivisions of the profit and loss statement. Examples of specific expenses connected with each function are:

1. Manufacturing overhead: power (for machinery), depreciation (on machinery, furniture and fixtures used in factory, hand and power trucks used in moving goods within the plant), insurance (on raw materials, work in process, machinery, etc.), supplies used in factory
2. Selling expense: traveling expense of sales force, rent of showroom, advertising, depreciation (on furniture and fixtures used in sales department), insurance (on finished goods, on equipment used in sales department), power (for operating air-conditioning equipment in sales department), supplies used in sales department
3. Administrative expense: executive salaries, legal fees, depreciation (on equipment used in administrative division), supplies used in administrative division, power (for operating air conditioner in administrative division)
4. Financial expense: interest on borrowed capital, depreciation, insurance, supplies, power in so far as these are related to the financial branch of the business

Note particularly that certain expenses are peculiar to each division, but that some recur in each class. Thus advertising is a distinctive selling expense, but depreciation occurs in each function, since each division makes use of capital assets whose life span is limited.

Each of the above listed divisions of a business is composed of departments in which are carried on the activities making up the function. In the factory a department is usually a unit for which a single foreman or supervisor is responsible. In it may be grouped a specific type of equipment (e.g., punch presses) or a specific operation may be performed there (e.g., heat treating). In the marketing division, typical departments might be advertising, selling, warehousing, and shipping. Costs incurred in a given department are grouped together to secure the total cost of operating the department for the period.

While most organizations are divided into departments for administrative purposes, the latter do not always suffice for the determination of costs. Sometimes when a group of related activities is performed within a department, costs may be subdivided by cost centers, each cost center representing one specific activity. The basis for setting up a cost center is the grouping of machines, methods, processes, or operations, so as to segregate work activities having a common interest. Expressed in other words, a cost center is a natural division of an organization for cost finding purposes. In this way it becomes possible to allocate directly to each center the specific costs and expenses associated with each. For example, assume that both manual and machine operations are performed in the same department. By separating the department into two cost centers it is possible to charge the power cost against the machine operations only. Failure to establish two cost centers would mean the indiscriminate charging of power cost to the department as a whole. Both operations are thus charged for power, even though the manual operation involved no power cost at all.

It is customary to classify manufacturing departments into producing and service departments. The former are those actively engaged in working on the product, performing operations such as cutting, drilling, molding, polishing, or weaving. The particular operations characterizing producing departments vary, of course, with each industry. Service department activities, however, are more or less common to all industries. Examples are storerooms, toolrooms, receiving department, factory office, repair department, building maintenance, and personnel department. By careful departmental classification it is possible to obtain the cost of operating each department. The way in which departmental costs merge into cost of product is explained in a later chapter.

Figure 18 illustrates the various bases of account classification thus far presented. It shows successive stages in the accumulation, distribution, and application of costs, by primary accounts, by elements of cost, and by functions.

Cost Behavior. When production increases, expenditures also increase because more materials are used, more hours of labor must be paid for, and there will be increases in certain manufacturing costs, such as power and repairs. However, some expenses do not increase in proportion to the increase in production. Thus an increase in production of 50% might increase expenses by only 25%. The reason for this is that a moderate increase in production can generally be obtained without increasing the size of buildings or purchasing more machines, or perhaps even without increasing the number of employees in departments such as engineering, personnel, and general management. For example, a plant which is operating forty hours a week can perhaps double its output by adding a second shift of workmen. But such addition does not increase the rent since the latter is a constant amount whether the factory operates at 200% or 60% of its normal activity, or not at all.

Costs which tend to vary directly *in total amount* with variations in production are called *variable* costs. Direct material and workmen's compensation insurance are examples of variable costs. Costs which are constant *in total amount* regardless of changes in production volume are called *fixed* costs. Examples are depreciation, property taxes, and executive salaries. Some costs, though they vary with production volume, do not increase or decrease proportionately with production. These are called *semivariable* costs. An example is furnished by maintenance and repair costs.

The above classification applies only to total costs incurred for specific items and not to unit costs of products. Unit costs of product behave in the opposite manner, as illustrated in Figure 19. The "A" section of this illustration shows that the total amounts of variable costs are in direct relation to volume produced which varies from 10 to 50 units while the amount of fixed costs remains constant. Section "B" demonstrates that as volume increases, the variable cost *per unit* has become a constant while the fixed cost *per unit* varies inversely to the increase in volume.

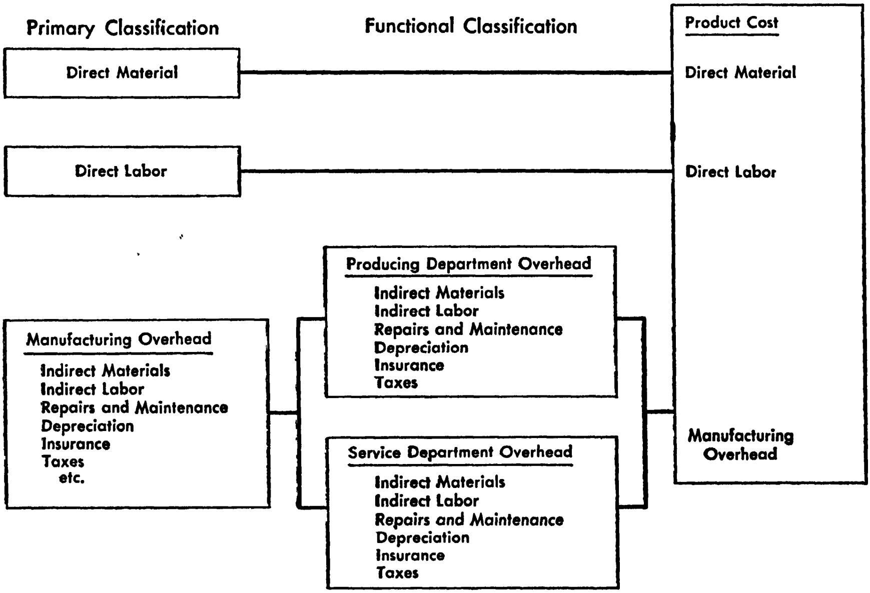

FIGURE 18. Chart of Factory Costs

Time at Which Costs Are Determined. Costs may be determined either before or after the goods have been made. When costs are determined after the manufacturing operations have been performed, they are called historical costs or actual costs. Costs which are calculated in advance of production are called predetermined costs. When the latter are based upon careful measurement of what it ought to cost to produce the goods, they are termed standard costs.

Historical or actual costs are necessary to prepare the profit and loss statement. For purposes of managerial control, it is necessary to have predetermined or standard costs in addition to actual costs. The predetermined costs serve as a goal which indicates how much it should cost to do the job. Then, from time to time, what it actually costs is compared with the standard costs to measure efficiency of performance. Since prices must often be set and production planned before actual costs are incurred, predetermined costs are highly useful for these purposes.

A. TOTAL COSTS				B. UNIT COSTS		
Number of Units Produced	Variable Cost	Fixed Cost	Total Cost	Variable Cost per Unit	Fixed Cost per Unit	Total Unit Cost
10	$ 5.00	$5.00	$10.00	$.50	$.50	$1.00
20	10.00	5.00	15.00	.50	.25	.75
30	15.00	5.00	20.00	.50	.167	.667
40	20.00	5.00	25.00	.50	.125	.625
50	25.00	5.00	30.00	.50	.10	.60

FIGURE 19. Behavior of Fixed and Variable Costs Illustrated

Cost systems in use a generation ago commonly yielded only historical costs and, while adequate for determining the financial results of operations, they were much less valuable in helping management operate its business effectively. The usefulness of cost accounting as an effective management tool has been greatly broadened in recent years by incorporation of standard costs into the accounting plan.

Costing Units. Costing units are the terms in which costs are expressed. The units used to measure quantity of product produced are familiar examples of cost units. Thus the cost of cloth is stated by the yard, of oil by the barrel, and of canned fruit by the case. The costs of articles like automobiles, radios, and furniture are expressed as so much per unit of one; other articles are costed in multiples of one as, for example, bricks which are costed by the thousand.

The different departments within a factory may have different costing units, and these may differ from the unit in which the final product is expressed. For example, in manufacturing machines, castings produced by the foundry may be costed by the pound, machined parts may be costed by the hundred, power from the company's power plant by the kilowatt hour, and the finished machine by the single unit. Sometimes it is desirable to have a unit which measures production of diverse products in the same department as well as products in several departments. Then some unit which can serve as a common denominator is chosen as a costing unit. The labor hour and the machine hour are often used for this purpose. In this way a department which produced 100 pieces of Part No. 101 in 160 man hours and 500 pieces of Part No. 107 in 200 man hours would have its production expressed as 360 man hours. The cost of production in the department would then be expressed as so much per man or labor hour.

All of the above are commonly referred to as unit costs of production. The determination of unit product costs is one of the principal aims of cost accounting. Other costing units, however, are sometimes used. Thus costs may be accumulated by the job or order, a unit which includes all the costs of doing what is called for by a specific order or contract. A department may also be a costing unit. In this case all the costs of operating the department for a given period of time are referred to as the departmental cost.

Chart of Accounts. A chart of accounts is merely a list of all the accounts used in a given company together with their symbols. The account titles are usually listed in the company manual in the order in which they appear in the company's financial statements and this is also the arrangement used in the ledgers. Hence the chart of accounts also serves as an index to the ledgers. It is understood that the list covers all accounts in the general ledger, factory ledger, and such subsidiary records as the manufacturing overhead, stores, finished parts, and finished goods ledgers.

Account Codes. Account titles are, in practice, usually given symbols in order to avoid lengthy descriptions. Symbols are really a form of shorthand used in account classification. By use of symbols, relationships may be indicated in an orderly way and lengthy descriptions reduced to simple form. Thus it is much simpler to write Account 241 than it is to write "Manufacturing Overhead, Salaries and Wages, Elevator Operators." By proper selection and arrangement of symbols in the form of numbers or letters or both, it is possible to indicate the various classifications to which an account belongs and its relationship to other accounts in the chart of accounts. Thus one digit or letter may represent a plant, another a department in the plant, another the group to which the cost belongs. A set of such symbols is called a code. Codes are used in industry for identification and classification of many things. Common examples are items of plant and equipment, inventories, products, manufacturing operations, and account titles.

It may be seen therefore that the objective of coding accounts is to enable the general accounting as well as the cost accounting department to classify transactions properly by charges and credits to specific accounts, to locate those accounts quickly and to reduce the clerical work, particularly in connection with the handling of great masses of data, such as time tickets, material requisitions, production orders, and vouchers. To be most effective, the system should be as simple as circumstances permit. It should also be flexible enough to permit adaptation to changing conditions, such as the necessity for more detailed information by reason of the introduction of new products and the natural growth in size of the business. Finally the code should be easy to remember.

Numerical Codes. As the name indicates, numerical codes may be developed by assigning numbers to the accounts. This may be done in three ways:

1. Sequence codes
2. Block numbering
3. Decimal codes

SEQUENCE CODES. Sequence codes take the form of consecutive numbering of items. They are useful only when there is no need for subdivision by groups. Items to be coded should be arranged in some logical order before numbers are assigned. Since numbers are assigned in sequence, additions can be made only at the end of the classification. For this reason sequence numbering is ill adapted for use in account classification in ledgers. As new accounts are introduced by adding numbers at the end, the logical arrangement of accounts is bound to be disturbed. In turn this would slow up posting by making it more difficult to locate an account quickly. In accounting, sequence codes are commonly used in connection with material requisitions, purchase orders, vouchers, etc. which are numbered in sequential order according to date of issue.

BLOCK NUMBERING. To overcome the most obvious defect of the sequence code, block numbering is commonly resorted to. This consists of reserving a group of numbers for a particular account classification. For example, a block of from twenty-five to fifty numbers may be assigned to each of the subheadings appearing in the balance sheet and profit and loss statement. Thus numbers from 1 to 50 may be used to designate current assets, 51-100 fixed assets, etc. Expansion is provided by assigning more numbers in a block than can be used at time of installation. It is even possible to preserve the orderly arrangement of the accounts by leaving some unused numbers after an account where there is a likelihood that additional accounts may be needed at that point. For example numbers 1 to 5 may be used for Cash, even though only one bank account is used at present. As the business grows and more bank accounts are opened, numbers 2, 3, 4, and 5 may be assigned to them. Similarly numbers 6 to 10 may be used for Accounts Receivable. In time separate accounts may be opened for Trade Accounts Receivable, Due from Employees, and Intercompany Accounts Receivable.

The chart of accounts in the cost manual issued by the Underwear Institute illustrates how a block code can be applied to the cost accounts. The chart makes provision for expansion; each number indicates the major class as well as the individual account.

CHART OF MANUFACTURING COSTS AND COMMERCIAL EXPENSES

Account	No.
RAW MATERIAL ACCOUNTS:	
Fabrics; Cloth; Piece Goods	350
(Separate accounts may be kept for different kinds of cloth.)	
Tapes	351
Elastics	352
Buttons	353
Thread	354
Pin Tickets and Labels	355
Sundry Other Materials	356
Boxes	357
Box Department Materials	358
(More detailed accounts may be provided and separate accounts may be provided for each mill.)	
DIRECT OR PRODUCTIVE LABOR ACCOUNTS:	
Laying Up and Cutting	371
Finishing—Sewing, Buttonholing, Etc.	372
Inspection or Examining	373
Pressing	374
Boxing	375
(Separate accounts may be kept showing more accurate classifications and accounts recording piece and day labor separately may be provided; also, separate accounts for each mill may be provided.)	
INDIRECT OR NONPRODUCTIVE LABOR ACCOUNTS:	
Superintendence or Supervision	390
Laying Up and Cutting	391
Finishing—Sewing, Buttonholing, Etc.	392
Inspection or Examining	393
Pressing	394
Boxing	395
Mill Office	396
General Nonproductive Salaries and Wages	397
(Separate accounts may be kept showing more detailed classifications for each mill.)	
OTHER FACTORY OVERHEAD ACCOUNTS:	
Sewing Machine Needles	411
General Mill Supplies	412
Mill Office Supplies	413
Box Department Supplies	414
Fuel	415
Power and Light	416
Water	417

Account	No.
Taxes (Real Estate, County, City, School, Personal Property, Etc.)	418
Repairs and Maintenance	419
Insurance—Fire, Liability, Etc.	420
Rents	421
Machinery Rentals or Royalties	422
General Mill Expenses	423
Trucking or Automobile Expenses	424
Freight and Cartage In (when not included with cost or raw materials or supplies)	425
Depreciation on Mill Buildings and Machinery and Equipment	426
Waste or Spoilage	427

(Separate accounts may be provided to show more detailed classifications for each mill or for each department of the mill.)

DECIMAL CODES. Decimal coding in industry is an adaptation of the Dewey decimal system used internationally in libraries. It is the method of coding most commonly used. Major and minor classifications are represented by succeeding digits of a number. This plan allows for indefinite subdivision. The first digit of the code number represents the major classification, the second digit, the secondary classification, and subsequent digits still finer subdivisions. The system is particularly useful where it is desired to combine two fairly extensive classifications, as, for example, departments and expense accounts or a functional and a primary expense classification.

Under a strict decimal system, no more than nine subdivisions may take place at any one point. Where more than nine subclassifications are required, two methods may be employed to overcome this handicap. The first consists of making the ninth subdivision a "Miscellaneous" one and then subdividing the latter which would provide a maximum of nine more accounts. The other method is to change the basis of classification. In such cases a decimal point may be used. Figures to the left of the decimal point are on a decimal basis, to the right of the decimal point on a sequential or perhaps block numbering basis.

An interesting application of decimal classification is found in the Uniform Accounting Manual for the Rubber Manufacturing Industry. Major account classifications are assigned numbers from 1 to 9:

1. Cash, Marketable Securities, and Receivables
2. Merchandise, Materials, and Goods in Process
3. Properties, Plants, and Securities
4. Prepaid, Deferred, and Miscellaneous Assets
5. Goodwill, Patents, and Trade-Marks
6. Current Liabilities
7. Fixed Liabilities, Capital Stock, and Surplus
8. Income and Expense on Sales
9. Other Income and Expense

Each of these major classifications is further subdivided. Thus, "Income and Expense on Sales" is subdivided as follows:

81. Sales
    81.1 Sales (Own Products)
    .2 Sales (Outside Products)
    .3 Returned Goods
    .4 Sales Allowances
    .5 Outward Freight
82. Deductions from Sales
83. Cost of Sales
    83.1 Cost of Sales (Own Products)
    .2 Cost of Sales (Outside Products)
    .3 Cost Variances
84. Unused Code Numbers
85. Selling Expense
86. Administrative Expense

In general, the code presented in this manual utilizes only two digits before the decimal point; but a three-, four-, or five-digit figure may be used to indicate major and minor classifications. Thus figure 86 is assigned to Administration, 867 to the comptroller's division, 8675 to the general accounting division of the comptroller's division, and 86752 to accounts payable department in the general accounting division. Code numbers following the decimal point are then used to indicate primary expense accounts. Thus code 86752.101 would serve to designate salaries in accounts payable department, and code 86752.193 stationery and office supplies for that department.

Letter Codes. In addition to numerical codes, letters may be used to provide code designations. Letters may be used alone or in combination with figures. They may be assigned in alphabetical order or according to the sound of the name of the individual item being classified. Symbols of this latter type are called mnemonic symbols. Thus in a classification of accounts, the letter "A" might be assigned to Assets, "L" to Liabilities, "X" to Expenses, etc. A second letter may be used to indicate subsidiary classification; for example, "AC" might indicate Current Assets, and "AF" Fixed Assets. In short, each succeeding letter is a subdivision of the one before it just as each digit in a decimal code represents a subdivision of its immediate predecessor.

The most obvious advantage of mnemonic coding is that it provides much greater range for subdivision. The letters "I" and "O" are not generally used by mnemonists because of their similarity to numbers. Even so after eliminating these two letters the possibility of twenty-four

	ASSETS					LIABILITIES					REVENUE AND EXPENSE				
	A	B	C	D		E	F	G	H		J	K	L	M	
												OVERHEAD			
	CURRENT	INVENTORY	FIXED	DEFERRED		CURRENT	FIXED	RESERVES	CAPITAL		SALES DEDUCTIONS, COSTS	FACTORY	COMMERCIAL	OTHER INCOME & CHARGES	
1	Cash in Office	Lumber	Land		1	Payroll Accrued		Reserve for Depreciation on:	Capital Stock Common	1	Sales	Supervision	Executive Salaries	Interest Received	1
2	Cash in Banks	Finishing Material	Buildings	Interest Prepaid	2	Notes Payable Banks		Buildings		2		Repairs to Buildings	Postage	Discounts Received	2
3		Upholstering Material	Machinery		3			Machinery	Surplus	3	Sales Returns	Repairs to Machinery & Equipment	Printing & Stationery	Sundry Sales & Income	3
4	Accounts Receivable Trade	Hardware	Miscl Equipment		4	Accounts Payable Trade		Miscl Equipment		4	Sales Allowances	Yard & Kilns	Telephone & Telegraph		4
5	Accounts Receivable Other	Plating Material	Office Furn. & Fixt.	Insurance Unexpired	5	Accounts Payable Other		Office Furn. & Fixt.	Profit & Loss	5	Freight out	Heat, Light & Power	Donations		5
6					6					6	Discounts Allowed	Trucking & Shipping	General Office Exp.		6
7		Mill Supplies			7					7		General Factory Exp.	Office Payroll		7

8		Power Plant Supplies	Autos & Trucks		8	Provision for Bad Debts		Autos & Trucks		8		Insurance a–Liability b–Fire & Other	a–Bank Exchange b–Directors Fees		8
9					9					9		Taxes a–General b–Social Security	Commissions		9
10		Work in Process Material			10	Discounts Accrued				10		Depreciation	Trucking		10
11		Work in Process Labor			11	Taxes Accrued				11	Factory Cost of Sales	Freight in	Rent & Exp. of Sales Rooms	Interest Paid	11
12	Life Insurance Cash Value	Work in Process Overhead		Advances to Salesmen	12					12	Commercial Cost of Sales	Indirect Labor	Catalogs	Life Ins. Expense	12
13					13					13		Mill Supplies Used	a–Bad Debts b–Advertising		13
14					14					14			Photo Supplies	Federal Income Taxes	14
15					15					15					15

FIGURE 20. Chart of Accounts Combining Numerical and Letter Coding

subdivisions at each stage remains. An example of mnemonic coding applied to a few balance sheet accounts follows:

- A Assets
  - A C Current Assets
    - A C A Accounts Receivable
      - A C A T—Trade Accounts Receivable
      - A C A V—Miscellaneous Accounts Receivable
    - A C N Notes Receivable
      - A C N T—Trade Notes Receivable
      - A C N A—Trade Acceptances
      - A C N F—Notes Receivable—Officers
    - A C C Cash in Banks
      - A C C G—Guaranty Trust
      - A C C C—Central Hanover
    - A C P Petty Cash
  - A F Fixed Assets
    - A F L Land
    - A F B Buildings
    - A F M Machinery
    - A F T Testing Equipment
    - A F L Tools
- L Liabilities
  - L C Current Liabilities
    - L C A Accounts Payable
    - L C N Notes Payable
  - L F Fixed Liabilities
    - L F F First Mortgage Bonds
    - L F D Debentures

It is to be noted that ordinarily the first letter of the word to be coded is used as the symbol. But where that initial has already been used, an effort is usually made to employ the secondary sound of the word to be coded. Thus the symbol for the fixed asset "tools" is A F L, since the letter T had already been used to denote testing equipment. Note also A C N F, Notes Receivable from Officers, where "F" was substituted for the unwelcome "O". Letter "V" is usually reserved for miscellaneous items, "V" suggesting the word "various."

This plan of coding is seldom used. It is more commonly employed by engineers, particularly in connection with material classifications. A more common type of coding occurs where letters and numbers are combined. Examples familiar to everyone are provided by the Air Force's coding of planes. In this code the letters P and B indicate pursuit and bomber types respectively, the number following the letter indicating the model. While a plane is being designed, built, and tested, in other words, while it is in the *experimental* stage, it is denoted as XB or XP followed by the model number.

An interesting combination of letters and numbers is furnished by the chart of accounts shown in Figure 20. The letters are not mnemonic; they indicate merely the position on the chart. In this chart of accounts for a furniture manufacturer, the letters from "A" to "M" are used to represent main classifications, while numbers are added to indicate specific accounts. Thus account B 12 is Work in Process Overhead. Note that the letter in all cases has special significance, but there is no relationship between accounts with the same number, since in the latter case they represent accounts appearing on the same line in the chart but falling into different classifications.

QUESTIONS

1. The manufacturing process can be viewed as a capitalization process from the accounting viewpoint. Explain.
2. Differentiate between product costs and period costs.
3. Contrast the usual accounting treatment of manufacturing overhead items as compared with selling expense stressing their treatment as either product or period costs.
4. What type of cost system (process or job order) would you expect to find in each of the following industries:
   a) Ice cream manufacturing
   b) Coal mining
   c) Machine tools
   d) Clothing
   e) Vegetable canning
   f) Printing
   g) Shipbuilding
   h) Petroleum refining
5. List five items of expense classified by nature of expenditures and then reclassify them by four functions indicating the basis to be used in distributing these expenses to functions.
6. Why do financial accountants generally ignore classifying expenses by the behavior pattern they display?
7. What is the purpose of a chart of accounts?
8. Prepare two different coding systems for the following account titles found in manufacturing overhead ledger:

   Factory indirect labor, repair labor—equipment, repair labor—buildings, cost and payroll salary, overtime, vacations, bonus, holiday pay.

Group insurance, employer's unemployment insurance, employer's federal insurance contribution. Factory operating supplies, repair materials—equipment, repair materials—building, fuel used. Idle time, spoilage, defective material, obsolete stock scrapped.

9. Prepare two different coding systems for the following general ledger accounts:

   Home office petty cash, branch office petty cash—Tulsa, branch office petty cash—Altoona, cash in First National Bank—Tulsa, cash in Altoona National Bank, Security and Exchange Bank—payroll account, Sioux City Bank—payroll account. Accounts receivable—trade, reserve for bad debts, advances to salesmen, claims against carriers. Branch inventories finished goods, factory inventory finished goods, work in process, stores. Unexpired insurance, prepaid sales tax, prepaid franchise tax, prepaid personal property tax.

10. Assume a general ledger control account in the factory ledger numbered 900. Prepare a numerical coding system for the key accounts you might find in this factory ledger.

Chapter 6

PROCESS COSTS

Definition of Process Costs. Process costing represents a type of cost procedure for continuous or mass production industries. In such industries output consists of like units, each unit being processed in like manner. Therefore it is assumed that the same amount of material, labor, and overhead is chargeable to each unit processed. The cost of a unit at the end of any manufacturing process can be readily determined provided costs are accumulated on a process basis and a record of units produced is available. Any industry manufacturing a product in mass or bulk so that a differentiation of units is difficult or impossible will find use for process costs. This holds true whether the plant produces a single commodity, a group of allied products using the same facilities, or a group of distinct products having no relation to one another. In the first group would fall blast furnaces, ore smelters, clay pits, collieries, coal mines, and the like. In the second group, producing an allied line of products, one may find chemical plants of all sorts, turning out, for example, a line of wall paints, or refineries cracking petroleum resulting in a wide variety of products; here also are found brick plants producing a variety of bricks and tile; dairies which convert the milk into butter and various kinds of cheese; sugar refineries producing different kinds of sugar products. In the third group, manufacturing independent products, may be found plants turning out such dissimilar things as radios and refrigerators, auto paints and gunpowder. In such cases, it is customary to subdivide the plant into major divisions, each one constituting a complete unit for turning out a given product.

In all these instances, it will be noticed that there is a uniform or homogeneous mass of product no single unit of which may be charged with any individual item of cost. Whatever costs are incurred must be absorbed by the product as a whole and then spread evenly over the units making up the product. As a result process costs represent *average* costs.

For example, if in a given month 10,000 gallons of white lead paint were produced at a total cost for material, labor, and overhead of $40,000 the average unit cost of production is assumed to be $4 per gallon, even though there may well have been cost fluctuations at various times during the month.

Thus the conditions for use of process costs are:

✓1. Continuous or mass production
✓2. Loss of identity of individual items or lots
✓3. Standardization of product and processes

Advantages and Disadvantages of Process Costs. The chief advantages of process costing are:

✓1. Costs are computed periodically, usually at the end of the month only.
✓2. Ease in computing average costs, provided the product is homogeneous.
✓3. A minimum of clerical effort and expense.

As opposed to these, the disadvantages of process costing are:

✓1. Where historical process costs are used, they are not determined until the end of the cost period. This has a tendency to delay statement preparation.
✓2. Average costs do not always reflect the fact that some products cost more than others. Differences in unit costs are reflected in inventory values of work in process, finished goods, and cost of sales, especially where, in computing unit costs, it is often necessary to take into account the stage of completion of the closing inventories.

Departmentalization. Because of the fact that units of product in process type industries are as a rule not identifiable, costs are based on processes. These processes are usually represented by departments, and therefore one of the most important features necessary for the operation of process costs is the departmentalization of the plant. In process costing the terms process and department may be used interchangeably. Proper departmentalization makes possible the accumulation of process cost data on a uniform basis. The size of a department is a matter of convenience and operating efficiency; but to insure correct distribution of the manufacturing charges it is necessary to indicate the limits of each process.

All manufacturing costs are first allocated to departments. These costs include material, labor, and manufacturing overhead. In short, departmental accounts are really subdivided work in process accounts. In addition, figures for production are collected by departments. In this way, it is possible to work out unit cost figures for each department.

Production Orders. Where production is continuous, special production orders are not required, as in the case of ice plants, mining, quarrying, and steam plants. This involves planning of the work so that continuity of production is maintained. Where several products are manufactured, orders must be planned. An excellent illustration is a bakery, because it produces a variety of perishable products in which demand and production must be synchronized daily to avoid excessive stale loss. Hence daily bake orders are resorted to. These orders are based on advance requisitions by salesmen and show the various quantities of the different types of dough required. Formula cards are prepared for each dough showing mixing and fermentation times and temperature at each stage. In addition, a schedule is made up which routes each dough through the appropriate processes.

Operation of Process Accounts. Costs for material, labor, and manufacturing overhead are charged to the usual accounts, analyzed by processes, and distributed by appropriate journal entries to process accounts. Production figures are reported daily by processes, and accumulated for the entire cost period. For purposes of computation by the cost accounting department at the end of the month, a record of production must show the following information relative to quantities:

1. Finished product on hand at beginning of period
2. Goods still in process at beginning of period, and their stage of completion expressed in percentage form
3. Quantity received from preceding process
4. Quantity delivered to next succeeding process
5. Finished product on hand or in process at end of period
6. Goods still in process at end of period and stage of completion

On the basis of production data and figures in the process accounts, the cost department computes average unit costs, and prepares journal vouchers to cost the production transferred to next process and the inventory on hand in each process.

Material Costs. A perpetual inventory is, of course, desirable; this is controlled on the general ledger by a Stores account. Emphasis, however, is on providing means for charging materials to the proper process and product at the time of consumption. As material is issued, the requisitions are posted to the stock ledger cards, sorted by processes and summarized periodically by means of material summaries which in turn give rise to the usual journal vouchers debiting each process and crediting Stores.

Often only a few raw materials are used. This is particularly the case in plants making a single commodity. In such cases accounts may be kept with each raw material in the general or factory ledger. In ice making, for example, materials consist of ammonia and water. In the making of pig iron, the ingredients are iron ore, coke, limestone, and scrap iron. For this type of manufacturing even material requisitions may be dispensed with, and so-called consumption reports substituted. These reports may be prepared in two ways:

1. By formula
2. By proration

FORMULA COSTS. Dispensing with material requisitions occurs particularly in chemical plants where the raw material content may be determined from specific formulas used in preparing the raw materials. It is possible therefore to determine from the production records just how much of each type of material was consumed. The method is illustrated in the case of plate glass manufacture where the raw materials consisting of sand, limestone, etc. are charged into work in process on the basis of a prepared batch formula. Each month the quantity of each material used is determined by multiplying the quantity in each batch by the number of batches processed during the month. An allowance is made for weight losses. This scheme is of course of strictly limited applicability. It is always wise to employ stores requisitions; they perform a double function, serving as a disciplinary or managerial force in guarding against unauthorized issues, and as an accounting device. Thus, even if the stores issues can be calculated without recourse to the requisitions, the latter may still be maintained for the reason mentioned above.

PRORATED MATERIAL COSTS. Where more than one product is being manufactured, it is first necessary to charge each department, and then to charge each product passing through the department. If the materials are withdrawn for specific products, the resulting accounting process is simple. All that need be done is to label the requisitions in such a way as to indicate both the department and product, so that the necessary costs may be accumulated on the product cost sheets. However, materials withdrawn from stores are often merely charged to departments, since the same materials may be used within the department on different products. In that case, material costs after being charged to the department must be prorated to the different products on an estimated basis, such as bulk (tonnage, gallons) or individual units. An illustration is shown in Figure 21.

Direct Labor. After the daily payroll is made up, each department's time tickets are classified as to direct and indirect labor and summarized on a monthly payroll summary. This may be accomplished by sorting time tickets or clock cards and summarizing these on labor distribution sheets. The resulting journal entry is of the usual type charging each process and crediting Accrued Payroll.

	Total	Product A	Product B	Product C
Number of units produced	10,000	4,000	5,000	1,000
Average weight per unit	1.6 lbs.	1.25 lbs.	1.4 lbs.	4 lbs.
Total pounds produced	16,000 lbs.	5,000 lbs.	7,000 lbs.	4,000 lbs.
Material cost per pound . . .	$1.25	$1.25	$1.25	$1.25
Raw material proration .	$20,000	$6,250	$8,750	$5,000
Material cost per unit	$2.00	$1.5625	$1.75	$5.00

FIGURE 21. Proration of Raw Material Costs

Manufacturing Overhead. Manufacturing overhead is collected, distributed, and applied to the product very much as under any other scheme of cost accounting. If only one product is manufactured, all *actual* expenses, analyzed by processes, are charged to it by being transferred to Work in Process. If there is more than one process, overhead is distributed to each process on some equitable basis.

Where *several products* are produced simultaneously or in successive runs, overhead may be charged to products by:

1. Apportioning on some convenient basis actual expenses within each process to products worked on
2. Use of predetermined departmental expense rates

In the first instance, all overhead is collected, usually on an analysis sheet, known as an overhead distribution sheet, and the total overhead of each process is prorated to the individual products on the basis of weight, value, time, or other factor. If predetermined expense rates are to be used, the following steps are necessary:

1. Classification and accumulation of expenses on an estimated basis.
2. Distribution of expenses departmentally; for this purpose distribution sheets are used.
3. Reduction of departmental expense totals to a rate to be applied to production. For this purpose any suitable base may be used; such as unit of productive output, direct labor cost, direct labor hours, machine hours, or product hours.

The use of such applied or predetermined rates is generally favored since the task of charging overhead is made easier than where actual expenses are prorated. Also it makes possible the computation of costs at any time instead of only at the end of the month.

Use of Distribution Sheets. The work of analyzing and summarizing process costs is facilitated by use of a distribution sheet. Accounts are listed down the page, producing and service departments across the page. In effect this becomes a process cost sheet for the product, since it includes, in addition to overhead, the direct material and labor costs. Figure 22 illustrates such a distribution sheet for a brewery. The first

	Total	General Plant 200	Power Plant 300	Brewery 400	Racking Room 500	Bottling House 600	Delivery 700	Selling 800	Administrative 900
01 to 019—Raw Materials									
01 Choice Malt				x					
02 Caramel Malt				x					
03 Other Malt				x					
04 Rice				x					
05 Grits				x					
06 Domestic Hops				x					
07 Imported Hops				x					
08 Other Raw Materials				x					
09 Grain Sales (Credit)				x					
10 Crowns and Labels					x				
21 to 29—Salaries and Wages									
21 Departmental Labor		x	x	x	x	x	x		
22 Repair Labor, Cases						x			
23 Repair Labor, Cooperage					x				
24 Office Salaries		x					x	x	x
25 Salesmen's Salaries								x	
27 Executive Salaries		x						x	x
28 Superintendence		x	x	x	x	x	x		
29 Repair Labor—Buildings, Machinery, and Equipment		x	x	x	x	x			x
31 to 39—Supplies									
31 Water			x	x	x	x			
32 Purchased Power		x	x	x	x	x		x	x
33 Fuel			x						
34 Repair Materials, Cases						x			
35 Repair Materials, Cooperage					x				
36 Miscellaneous Supplies		x	x	x	x	x	x	x	x
37 Repair Materials—Buildings, Machinery and Equipment		x	x	x	x	x			x
38 Purchased Repairs		x	x	x	x	x			x
39 Stationery, Office Supplies and Postage		x						x	x

(*Continued on following page*)

FIGURE 22. Departmental Cost Analysis

	Total	General Plant 200	Power Plant 300	Brewery 400	Racking Room 500	Bottling House 600	Delivery 700	Selling 800	Administrative 900
40 to 59—Miscellaneous Expense									
40 Compensation Insurance		x	x	x	x	x	x	x	x
41 Beer Lost and Consumed					x	x			
42 Bottle Breakage						x			
43 Cullet Sales (Credit)						x			
44 Case Depreciation						x			
45 Trucks Hired							x		
46 Advertising .								x	
47 Telephone and Telegraph		x					x	x	x
48 Travel		x						x	x
49 Miscellaneous Freight and Cartage In				x					
50 Miscellaneous Expense		x	x	x	x	x	x	x	x
55 Donations									x
56 Dues and Subscriptions									x
57 Professional Services									x
60 to 69—Fixed Charges									
60 Real Estate Taxes		x	x	x	x	x		x	x
61 Personal Property Tax		x	x	x	x	x		x	x
62 State Franchise Tax									x
63 Federal Permit Fee		x							
67 Insurance		x	x	x	x	x	x	x	x
68 Interest on Investments		x	x	x	x	x		x	x
69 Depreciation—Buildings, Machinery. and Equipment		x	x	x	x	x		x	x

FIGURE 22. Departmental Cost Analysis (*Continued*)

two columns after the totals are for general plant and power plant expenses and represent service departments whose totals are eventually absorbed by the producing departments. The next four are the producing departments, while the last two cover the selling and general administrative overhead.

In transferring process costs it is important to have the accounts arranged on the process cost sheet and the process ledger in the order in which the operations are performed. In this way a continuous chain of entries results, charging the succeeding process and crediting the prior process.

The result of all this procedure is to charge each producing department with material costs, labor costs, and with manufacturing overhead. The sum of these elements divided by the production of each department as gathered from the production reports gives the unit costs of manufacturing in that department. The labor and overhead incurred are known as the conversion cost, and this together with the material cost is the basis of transferring the cost of the product finished from the first department to the next department. The balance of the Work inProcess account for the department making the transfer represents the closing inventory of unfinished work in that department.

Unit Costs. In its simplest form a unit product cost is determined for each process on the basis of material, labor, and overhead incurred in that process for a given production. Thus in a foundry, the cost per pound of metal at the spout is found by adding the value of the metal and other raw materials, cost of the cupola direct labor, and the applied manufacturing overhead and dividing the total by the number of pounds of good castings obtained. Where the same facilities are used to turn out several products, unit costs are obtained by either proration formulas or the introduction of process cost sheets to insure segregation for these costs. Thus in the manufacture of plate glass the batch department mixes raw materials and feeds them to the tank department. The costs of the batch department are prorated on the basis of the weights of the different kinds of glass produced by the tank department. Actually the weight of each thickness of glass is determined by reducing all thicknesses produced to a common thickness and then using a common unit weight per square foot.[1] The tank department costs are prorated to each thickness on the basis of the number of hours the tank department operated on each batch. A similar formula is used in the grinding and polishing department.

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[1] P. L. Harrold, "Outline of Factory Cost Procedure in Plate Glass Manufacture," *N.A.C.A. Bulletin*, XXI, 175.

From the formulas given above, unit costs can be computed provided the cost figures as well as the production figures are available. However, the existence of work in process at the beginning or end of the period necessitates a refinement of the above method of costing. Since a part of the cost incurred applies to units still in process, the total cost cannot be charged to units finished or transferred to another department for further processing. Costs must be spread over all the work of the department. Hence the production report figures are inadequate for this purpose for two reasons:

1. The production report covers only the physical movement of goods from process to process. It includes inventories in process at the beginning of a period which were at least partially completed in a prior period.
2. The production report does not include inventories in process at the *end* of a period on which some work has been done.

Effective Production Defined. To obtain correct unit costs it is necessary to spread the total costs over *all* work done in a department, both completed and incompleted. To accomplish this, the work of the department must be expressed in terms of a common denominator, referred to as the effective production. The latter, sometimes called *equivalent production,* represents the total work of a department or process in terms of *fully completed units.* This idea rests on the assumption that the work in producing 100 units of product one-half completed is equivalent to 50 units fully completed.

Stage of Completion. To obtain a figure for effective production, complete information must be available as to the stage of completion of both opening and closing inventories. In extreme cases, the stage of completion figures must be given separately for material, labor, and overhead. If all material is issued at the beginning of a process, the full material cost must be charged to inventory; as for labor and overhead, inventory may be only partially completed depending on the length of processing time; hence only a portion of labor and overhead costs must be charged to the inventory. If material, labor, and overhead are consumed uniformly throughout the process, a single computation of effective production suffices.

Methods of Computing Effective Production. There are two formulas for computing effective production. The first is similar to the cost of sales formula for a trading concern. All figures except the final one are expressed in terms of *incompleted* units, that is, units on which no work at all has been done. Thus:

Method I. Incompleted Units Method

1. Inventory at beginning, equivalent incompleted units ....
2. Add quantity put into process .. . .
3. Total incompleted units handled .. ..
4. Less inventory at end, equivalent incompleted units . .. .
5. Effective production (equivalent completed units)

The second method analyzes the work of a period for each stage of a department's work in terms of fully completed units.

Method II. Completed Units Method

	Equivalent Completed Units
1. Inventory at beginning; work needed to complete during current period (found by applying percentage to units in initial inventory)	. .
2. Units *started and finished* during current period (number of new units started, minus units in final inventory) ...	. .
3. Units started but not finished (percentage done on final inventory)	
4. Effective production	

Both methods must give the same result. There are three cases which call for different solutions in the determination of unit costs:

Case I. No opening and no closing inventory of work in process.
Case II. No opening inventory, but there is a closing inventory of work in process.
Case III. Both opening and closing inventories are present.

CASE I. NO OPENING AND CLOSING INVENTORIES. This presents no difficulties; unit costs are computed on the basis of actual production, as in the following situation. The actual production is 10,000 units.

PROCESS A

Material	$ 6,000.00	Transferred to B .	$12,000.00
Labor .	3,000.00	(10,000 × $1.20)	
Overhead	3,000 00		
	$12,000.00		$12,000.00

$$\text{Cost per unit} = \frac{\text{Total cost}}{\text{Quantity produced}} = \frac{\$12{,}000}{10{,}000} = \$1\ 20$$

CASE II. CLOSING BUT NO OPENING INVENTORY. In this situation where Work in Process shows a closing but no opening inventory, it is necessary to compute the effective production. Assume the same costs as in Case I; in addition, the production records reveal the following information:

	Units
Completed and transferred to next process	10,000
Inventory at end, 40% complete	2,000

Solution:

1. Effective production (using completed units method):	Units
Started and finished	10,000
Inventory at end (2,000 × 40%)	800
Effective production	10,800

2. Unit cost:

$$\frac{\text{Total cost}}{\text{Effective production}} = \frac{\$12,000}{10,800} = \$1.11111$$

3. Inventory value (2,000 × 40% × $1.11111)	$ 888.89
4. Value of transfer to process B (10,000 × $1.11111)	11,111.11
Total credited to process A	$12,000.00

PROCESS A

Material	$ 6,000.00	Transferred to B	$11,111.11
Labor	3,000.00	Inventory	888.89
Overhead	3,000.00		
	$12,000.00		$12,000.00
Inventory	$ 888.89		

CASE III. OPENING AND CLOSING INVENTORIES PRESENT. Effective production must be computed where there are opening and closing inventories. The following case illustrates the procedure:

PROCESS A

Opening Inventory	$ 200.00		
Material	6,000.00		
Labor	3,000.00		
Overhead	3,000.00		

Production data:	Units
Opening inventory, 30% complete	500
Put into process A	10,000
Transferred to Process B	9,500
Closing inventory, 40% complete	1,000

A. Effective production (incompleted units method)	Units
Opening inventory, 70% incomplete (70% × 500)	350
Put into process A	10,000
Total incompleted units handled	10,350
Less inventory at end, 60% incomplete (60% × 1000)	600
Effective production	9,750

Method II may be employed to check the above result as follows:

	Completed Units
1. Portion of opening inventory completed in current period (500 × 70%)	350
2. Started and finished during current period (10,000 — 1,000)	9,000
3. Portion of closing inventory completed in current period (1,000 × 40%)	400
Effective production	9,750

B. Unit current process cost:

$$\frac{\text{Total current costs}}{\text{Effective production}} = \frac{\$12{,}000}{9{,}750} = \$1.230769$$

C. Closing the process account:

Total debits	$12,200.00
Value of closing inventory (1,000 × 40% × $1.230769)	492.31
Balance, representing transfer to B	$11,707.69

D. Proof of charges transferred to B: There were 9,500 units transferred to the next process. These represented costs incurred as follows:

1. Opening inventory:	
500 units; cost incurred in prior period	$ 200.00
500 units; cost incurred in current period (500 × 70% × $1.230769)	430.77
2. Started and finished in current period (9,000 × $1.230769)	11,076.92
Total transfer to B	$11,707.69

Transferred Costs. Since process costs are figured on the basis of departmental activities, it is evident that they are cumulative as the product travels from process to process, that is, from department to department. In other words, the final cost of the product of one department constitutes the initial cost of that product in the next department. To it are added the material, labor, and overhead of that department, and the total transferred until the finished goods stage is reached. In this way the flow of costs follows the flow of production.

Steps in Closing Process Accounts. In closing process accounts, the following steps must be taken:

1. Compute effective production from given data.
2. Calculate net conversion or net process cost.
3. Compute unit conversion or unit process cost (item 2 divided by item 1).
4. Credit process account for value of closing work in process inventory on the basis of
    - *a*) Unit conversion or unit process cost taking into account stage of completion.
    - *b*) Full transferred unit cost.
5. Balance of process account represents charge to be transferred to the next process or to Finished Goods.

The following problem illustrates the entire process cost procedure:

PROCESS A

Inventory at beginning	$ 250.00	Transferred to Process B	?
Material	8,000.00	Inventory at end	?
Labor	4,000.00		
Overhead	2,900.00		

PROCESS B

Inventory at beginning	$1,430.00	Transferred to Finished Goods	?
Labor	5,000.00	Inventory at end	?
Overhead	2,000.00		

Production data:

	Department A		Department B	
	Number of Units	Stage of Completion	Number of Units	Stage of Completion
Opening inventory:				
Material	500	30%		
Labor		50	1,000	70%
Overhead		50		70
Put into process	15,000		12,500	
Completed and forwarded to next department	12,500		13,000	
Closing inventory:				
Material	3,000	100		
Labor		40	500	80
Overhead		40		80

No new material is added in Process B. Below are presented the working papers, the complete ledger accounts, and a process cost report. The incompleted units method is used in computing effective production.

COMPUTATION OF EFFECTIVE PRODUCTION

		Material		Labor and Overhead	
	Physical Units	% Incomplete	Equivalent Unfinished Units	% Incomplete	Units
PROCESS A:					
Opening inventory	500	70%	350	50%	250
Put into process	15,000		15,000		15,000
Total incompleted units handled	15,500		15,350		15,250
Less inventory at end	3,000	0	–	60	1,800
Effective production	12,500		15,350		13,450
PROCESS B:					
Opening inventory	1,000	0	–	30	300
Put into process	12,500				12,500
Total incompleted units handled	13,500				12,800
Less inventory at end	500	0	–	20	100
Effective production	13,000				12,700

COST OF PRODUCTION

	Department A				Department B			
	Effective Quantity	Physical Quantity	Total Cost	Unit Cost	Effective Quantity	Physical Quantity	Total Cost	Unit Cost
1. Opening inventory per ledger accounts		500	$ 250.00			1,000	$ 1,430.00	
2. Received from prior department .						12,500	12,970.86	$1.037669
3. Current costs:								
Material	15,350	15,000	8,000.00	$ .521173				
Labor ..	13,450		4,000.00	.297398	12,700		5,000.00	.393701
Overhead . . .	13,450		2,900.00	.215613	12,700		2,000.00	.157480
Total conversion cost	13,450		6,900.00	.513011	12,700		7,000.00	.551181
4. Total process charges .		15,500	15,150.00			13,500	21,400.86	
5. Less inventory at end (See Schedule below)		3,000	2,179.14			500	739.30	
6. Cost of good transferred		12,500	$12,970.86	$1.037669		13,000	$20,661.56	$1.589351

SCHEDULE OF CLOSING INVENTORY VALUES

DEPARTMENT A:		
Material	(3,000 × $ .521173)	$ 1,563.52
Labor	(3,000 × 40% × $ .297398)	356.88
Overhead	(3,000 × 40% × $ .215613)	258.74
Total Inventory		$ 2,179.14
DEPARTMENT B:		
Material . .		$ —
Labor	(500 × 80% × $ .393701)	157.48
Overhead	(500 × 80% × $ .157480) .	62.99
Prior Department Cost	(500 × 100% × $1.037669) .	518.83
Total Inventory	. ...	$ 739.30

PROOF OF COST OF TRANSFERS

DEPARTMENT A:		
1. Opening inventory:		
Cost carried forward (500 units)		$ 250.00
Cost to complete in current period:		
Material (500 × 70% × $ .521173)	$ 182.41	
Labor (500 × 50% × $ .297398)	74.35	
Overhead (500 × 50% × $ .215613)	53.90	310.66
2. New production completed in current period:		
Material (12,000 × $ .521173)	$ 6,254.08	
Labor (12,000 × $ .297398)	3,568.78	
Overhead (12,000 × $ .215613)	2,587.35	12,410.21
3. Value of goods transferred to B		$12,970.87
DEPARTMENT B:		
1. Opening inventory:		
Transferred cost carried forward		$ 1,430.00
Cost to complete in current period:		
Labor (1,000 × 30% × $ .393701)	$ 118.11	
Overhead (1,000 × 30% × $ .157480)	47.24	165.35
2. New production completed in current period:		
Material (12,000 × $ .393701)	$ 4,724.41	
Overhead (12,000 × $ .157480)	1,889.76	
Transferred from A (12,000 × $1.037669)	12,452.03	19,066.20
3. Value of goods transferred to Finished Stock		$20,661.55

COMPLETED LEDGER ACCOUNTS

PROCESS A

Inventory at beginning	$ 250.00	Transferred to B	$12,970.86
Material	8,000.00	Inventory at end	2,179.14
Labor	4,000.00		
Overhead	2,900.00		
	$15,150.00		$15,150.00
Inventory	$ 2,179.14		

PROCESS B

Inventory at beginning	$ 1,430.00	Transferred to Finished Goods	$20,661.56
Labor	5,000.00	Inventory at end	739.30
Overhead	2,000.00		
Transferred from A	12,970.86		
	$21,400.86		$21,400.86
Inventory	$ 739.30		

In this solution, opening and closing balances in inventories are not analyzed as to their material, labor, overhead, and transferred cost content. This can be done if desired; in fact, *separate process accounts* may be opened for each element of cost.

Short Cuts for Valuing Work in Process. From time to time, various short cuts have been proposed for simplifying the method outlined above. Thus, for example, it is possible to omit from consideration any work in process inventories. As long as their value is relatively small and the inventories remain fairly constant, the effect on unit costs is insignificant. This may be illustrated in the case of anthracite mining as shown in the following quotation:

> Work in process is a term practically unknown in anthracite. Although today some labor, materials and power are expended in loading a mine-car that may not reach the surface until tomorrow, no attempt is made to set this up against tomorrow's cost, because yesterday the same thing happened. The end of each working day completes a cycle which started yesterday or before, but which is fairly constant day by day.[2]

Effect of Process Losses. Process losses occur whenever the quantities accounted for through transfers and in-process inventories fall short of the total quantities put into a process. Hence a fairly common practice in process cost plants is to compute material yields along with production data and costs. Such yields are ordinarily obtained in percentage form computed from the following formula:

$$\%\ \text{yield} = \frac{\text{Product yield}}{\text{Product input}} \times 100$$

These formulas may be used also as indexes of operating efficiency.

One method of accounting for process losses is to compute separately the costs for such losses. This is one way of impressing upon management the effect of controllable losses for shrinkage. It is well illustrated in the manufacture of plate glass where the cost sheet shows the value of the shrinkage in each process. The shrinkage, expressed in feet, is obtained from production data for each process and is priced at the average cumulative cost of the glass received by each department. In the case of spoilage, the cost is transferred to a spoilage account and any salvage value is credited to the spoilage account at the time of sale. The net loss may be closed to Profit and Loss or to Cost of Production depending upon whether spoilage is considered a controllable or noncontrollable item. The truth is that some spoilage is inevitable and allowances should be made for it. *Excess* spoilage, however, is controllable and is quite properly the responsibility of the department which produced it.

Treatment of Spoilage. Many shrinkages are due to the nature of the operations and cannot be controlled. The most common method therefore in accounting for shrinkage is treatment by neglect. This means spreading process costs either over the equivalent units or over the good units obtained from the process, thus increasing the unit cost of the completed units which absorb the cost of shrinkage. For example, in a plant manufacturing rubber products there are rubber handling operations in which shrinkages occur because of elimination of foreign matter. This is compensated for by increasing the cost per pound of the remaining rubber. The same method is often applied in the treatment of spoilage. Thus in the clay products industry, costs are prorated over No. 1 salable ware which in this way absorbs the cost of defective and spoiled ware. Under this method no journal entries are required except for the salvage value, but each process must keep a record of shrinkage and spoilage.

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[2] C. E. Mengel, "Anthracite Productive Costs," *Bull. N.A.C.A.*, April 15, 1941, p. 898.

Where treatment by neglect is the rule, the salvage value is credited directly to the process account and the unit process cost may be computed by dividing the effective production into the net process costs (see Kiln Firing account in problem demonstrated later in this chapter, page 123).

Special care must be exercised in determining the effective production where shrinkage and spoilage are involved. These process losses may occur at the beginning of a process, during a process, or at the end of a process (as a result of final inspection). For the sake of simplicity the first two may be treated as though the lost units had never been started in the process. In this way the costs are spread over the equivalent units produced, that is over the units completed as well as those still in process.

Where spoilage occurs at the end of a process, the loss is charged only against the good units produced. No part of the loss is therefore chargeable against the closing inventory of work in process. Both methods are illustrated in the example below.

ILLUSTRATION 1:

PROCESS A

Inventory	$ 2,000.00	To Process B	$?
Material	5,000.00	Inventory	?
Labor	10,000.00		
Manufacturing Overhead	8,000.00		

Production data:

Opening inventory 25% complete	4,000 lbs.
Put into process	12,000 "
Transferred to B	10,000 "
Closing inventory 20% complete	5,000 "

Material is placed in process at the beginning of the process.

Required. Find the value of the closing inventory and of the transfer to B on two assumptions:

1. Spoilage of 1,000 lbs. occurred during the process.
2. Spoilage occurred at end of process. There is no salvage value.

Solution:

Assumption 1. Spoilage During Process

1. Effective production:

	Material	Labor	Overhead	
a) *Incompleted Units Method*				
Inventory (beginning)	0	3,000	3,000	
Put in process (12,000 less 1,000 lbs.)	11,000	11,000	11,000	
Total incompleted units handled	11,000	14,000	14,000	
Less: Inventory (ending)	0	4,000	4,000	
Effective production	11,000	10,000	10,000	
b) *Completed Units Method*				
Work completed in opening inventory	0	3,000	3,000	
Started and finished this period . .	6,000	6,000	6,000	
Work completed on closing inventory . . .	5,000	1,000	1,000	
Effective production .	11,000	10,000	10,000	
2. Current process costs . . .	$5,000.00	$10,000.00	$8,000.00	
3. Unit process costs . .	$ .454545	$1.00	$.80	$2.254545
4. Work in process (ending):				
Material (5,000 × $ .454545) .	$2,272.73			
Labor (5,000 × $1.00 × 20%) .		$1,000.00		
Overhead (5,000 × $ .80 × 20%) .			$800.00	
Total				$4,072.73
5. Finished goods transfer ($25,000.00 — $4,072.73)				$20,927.27
6. Unit cost of finished goods . .				$ 2.092727

Proof of Cost of Transfers

There were transferred to the next process 10,000 units, of which 6,000 were started and finished this period and 4,000 were from the opening inventory.

Inventory in process (beginning)	$2,000.00	
Work required to complete inventory:		
Labor (4,000 × $1.00 × 75%)	3,000.00	
Overhead (4,000 × $ .80 × 75%) . .	2,400.00	$ 7,400.00
Started and finished this period:		
Material (6,000 × $ .454545) .	$2,727.27	
Labor (6,000 × $1.00) .	6,000.00	
Overhead (6,000 × $ .80) . . .	4,800.00	13,527.27
Total value of transfers		$20,927.27

Assumption 2. Spoilage at End of Process

1. Effective Production	Material	Labor	Overhead	
a) Incompleted Units Method				
Inventory (beginning)	0	3,000	3,000	
Put in process	12,000	12,000	12,000	
Total incompleted units handled	12,000	15,000	15,000	
Less inventory (ending)	0	4,000	4,000	
Effective production	12,000	11,000	11,000	
b) Completed Units Method				
Work completed on opening inventory	0	3,000	3,000	
Started and finished this period (6000 + 1000 spoiled)	7,000	7,000	7,000	
Work completed on closing inventory	5,000	1,000	1,000	
Effective production	12,000	11,000	11,000	
2. Current process costs	$5,000 00	$10,000.00	$8,000.00	
3. Unit process costs	$.416667	$.909091	$.727273	$2.053031
4. Work in process (ending):				
Material (5,000 × $.416667)	$2,083.33			
Labor (5,000 × $.909091 × 20%)		$909.09		
Overhead (5,000 × $.727273 × 20%)			$727.27	
Total				$3,719.69
5. Finished goods (25,000 — 3,719.69)				$21,280.31
6. Unit cost of finished goods				$2.128031

Proof of Cost of Transfers

There were transferred to the next process 10,000 units, of which 6,000 were started and finished this period and 4,000 were from the opening inventory.

Inventory in process (beginning)	$2,000.00	
Work required to complete inventory:		
Labor (4,000 × $.909091 × 75%)	2,727.27	
Overhead (4,000 × $.727273 × 75%)	2,181.82	$ 6,909.09
Started and finished (good units):		
Material (6,000 × $.416667)	$2,500.00	
Labor (6,000 × $.909091)	5,454.55	
Overhead (6,000 × $.727273)	4,363.64	12,318.19
Value of units spoiled at end of process whose cost is absorbed by good units		
Material (1,000 × $.416667)	$ 416.67	
Labor (1,000 × $.909091)	909.09	
Expense (1,000 × $.727273)	727.27	2,053.03
Total value of transfer		$21,280 31

Comments on Solution. It is to be noted particularly that under Assumption 1, when spoilage occurs during the process, work in process and finished goods each absorb some of the spoilage cost. Under the second assumption, the entire loss is charged to the finished production.

This has the effect of lowering the ending work in process inventory cost, and raising still further the cost of the finished production:

	Assumption 1	Assumption 2
1. Unit cost for valuing ending inventory in process		
Material	$ .454545	$ .416667
Labor	1.00	.909091
Overhead	.80	.727273
Total	$2.254545	$2.053031
2. Unit cost of finished goods transferred	$2.092727	$2.128031

ILLUSTRATION 2. An illustration of a complete problem is presented below and solved to show the method of arriving at a unit cost in each department, cumulative cost in each department, and final cost:

National Brick Company

In the brick industry, costs are obtained by the use of the process method. The operations consist of (1) blasting, digging, and conveying the shale to the machines, called quarrying; (2) grinding, mixing, and molding the wet bricks, called pans and machines; (3) drying; (4) building the bricks in the kiln and preparing the kiln for firing, called setting; (5) burning or kiln firing; (6) opening the kiln and unloading and stocking the burnt bricks, called unloading.

The kilns are equipped with gas burners, the gas being produced on the premises. Coke obtained from the gas producer is sold.

The inventories of brick on hand November 1, 19— of the National Brick Company were as follows:

Burned brick in yard: 55,000 at $16.25	$ 893.75
Burned bricks in kilns: 200,000 at $14.75	2,950.00
Bricks burning in kilns: 100,000 at $10.20	1,020.00
Green bricks in kilns: 80,000 at $7.10	568.00
Green bricks in dryers: 50,000 at $5.60	280.00
	$5,711.75

Following are the total charges for the year from the various summaries and records:

Payrolls:	
Quarry	$12,000.00
Pans and Machines	36,000.00
Dryers	8,000.00
Setting	27,000.00
Kiln Firing	65,000.00
Unloading	30,000.00
Power	7,000.00
Summary of materials and supplies used:	
Quarry	$ 3,000.00
Pans and Machines	15,000.00
Dryers	1,500.00
Setting	750.00

Kiln Firing	$ 3,000.00
Unloading	4,000.00
Power	5,000.00
Schedule of coal consumption:	
Quarry—Steam Coal	$ 2,000.00
Drying—Steam Coal	5,000.00
Power—Steam Coal	6,000.00
Kiln Firing—Gas Coal	55,000.00
Accruals or prepayments schedules:	
Insurance	$ 2,500.00
Quarry Royalties	6,300.00
Taxes	3,000.00
Depreciation schedules:	
Quarry	$ 1,000.00
Pans and Machines	5,500.00
Dryers	750.00
Kiln Firing	26,250.00
Sheds and Stables	400.00
Power	1,750.00

Other indirect manufacturing charges arising through the voucher register were charged to the group account Superintendence and amounted to $10,000.

Sales of coke, a by-product of the gas producer used in kiln firing, amounted to $7,000.

Sales of broken and spoiled burnt bricks amounted to $2,000.

Power is divided 10% to kiln firing, 90% to pans and machines.

The production reports for the year ended October 31, 19—, were:

Wet bricks produced	18,000,000
Good and carried to dryers	17,600,000
Spoiled in drying	850,000
Spoiled in burning	830,000
Set in kilns	16,000,000
Sold	14,500,000

In calculating the number of bricks on hand October 31, of the total 100,000 are in the kiln completely burned, 250,000 are in process of burning, and 100,000 bricks are green. Bricks in process of burning and drying are taken as averaging half the process. Shale and wet bricks from the machine are used as produced and no inventory is taken into account.

The inventories are priced at cost. In the case of burned bricks unloaded, general factory overhead is included; in other cases it is excluded.

Required:

1. Prepare ledger accounts.
2. Prepare statements showing cost of manufacture, cost per thousand bricks for each operation, and trial balance of books after closing.
3. Process cost sheet.

Note: In drying and burning, a considerable number of bricks are spoiled. The spoilage cost should be charged against the dried bricks or burned bricks, removed from the dryers or kilns, and no portion of it should be charged against the half-dried or half-burned bricks still in the dryers or kilns. This is because the spoilage is determined when the bricks are taken out of the dryers or kilns, and is applicable only to those taken out. Presumably when the bricks still in process of drying are taken out, more spoilage will be discovered, and this additional spoilage will be chargeable to the bricks now in process.

Solution:

FACTORY LEDGER ACCOUNTS

QUARRY

(2) Payroll	$ 12,000.00	(11) Pans and Machines	$ 24,300.00
(3) Material and Supplies	3,000.00		
(4) Coal	2,000.00		
(5) Royalties	6,300.00		
(6) Depreciation	1,000.00		
	$ 24,300.00		$ 24,300.00

PANS AND MACHINES

(2) Payroll	$ 36,000.00	(12) Dryer	$ 98,575.00
(3) Material and Supplies	15,000.00		
(6) Depreciation	5,500.00		
(10) Power	17,775.00		
(11) Quarry	24,300.00		
	$ 98,575.00		$ 98,575.00

DRYER

		(13) Setting	$109,270.12
(1) 11/1/19 Inventory	$ 280.00	10/31 Bricks Drying	4,834.88
(2) Payroll	8,000.00		
(3) Material and Supplies	1,500.00		
(4) Coal	5,000.00		
(6) Depreciation	750.00		
(12) Pans and Machines	98,575.00		
	$114,105.00		$114,105.00
11/1 Bricks Drying	$ 4,834.88		

SETTING

(2) Payroll	$ 27,000.00	(14) Kiln Firing	$137,020.12
(3) Material and Supplies	750.00		
(13) Drying	109,270.12		
	$137,020.12		$137,020.12

KILN FIRING

11/1 Inventory:		(8) Coke Sales	$ 7,000.00
200M @ $14.75	$ 2,950.00	(9) Sale of Spoiled Bricks	2,000.00
100M @ 10.20	1,020.00	(15) Unloading	277,889.12
80M @ 7.10	568.00	10/31 Inventory, Burnt in Kilns	1,763.17
(2) Payroll	65,000.00		
(3) Material and Supplies	3,000.00	10/31 Inventory, Burning	3,274.45
(4) Coal	55,000.00	10/31 Inventory, Green	856.38
(6) Depreciation	26,250.00		
(10) Power	1,975.00		
(14) Setting	137,020.12		
	$292,783.12		$292,783.12
11/1 Inventory, Burnt in Kilns	$ 1,763.17		
11/1 Inventory, Burning	3,274.45		
11/1 Inventory, Green	856.38		

UNLOADING (BRICKS IN YARD)

(1) 11/1 Inventory	$ 893.75	(17) Cost of Sales	$314,477.16
(2) Payrolls	30,000.00	10/31 Inventory, Burnt Bricks in Yard	14,205.71
(3) Material and Supplies	4,000.00		
(15) Kiln Firing	277,889.12		
(16) Works Expense	15,900.00		
	$328,683.87		$328,683.87
11/1 Inventory	$ 14,205.71		

COST OF SALES

(17) Unloading	$314,477.16	(18) General Ledger	$314,477.16

GENERAL FACTORY OVERHEAD

(5) Insurance	$ 2,500.00	(16) Unloading	$ 15,900.00
(5) Taxes	3,000.00		
(6) Depreciation Sheds and stables	400.00		
(7) Superintendence	10,000.00		
	$ 15,900.00		$ 15,900.00

POWER

(2) Payroll	$ 7,000.00	(10) 10% Kiln Firing	$ 1,975.00
(3) Material and Supplies	5,000.00	(10) 90% Pans and Machines	17,775.00
(4) Coal	6,000.00		
(6) Depreciation	1,750.00		
	$ 19,750.00		$ 19,750.00

GENERAL LEDGER

(8) Coke Sales	$ 7,000.00	(1) 11/1 Inventories	$ 5,711.75
(9) Spoiled Brick Sales	2,000.00	(2) Payrolls	185,000.00
(18) Cost of Sales	314,477.16	(3) Material and Supplies	32,250.00
10/31 Balance	24,934.59	(4) Coal	68,000.00
		(5) Fixed Charges	11,800.00
		(6) Depreciation	35,650.00
		(7) Superintendence	10,000.00
	$348,411.75		$348,411.75
		11/1 Balance	$ 24,934.59

Exhibit A

STATEMENT SHOWING BRICKS PROCESSED, TOGETHER WITH TOTAL AND UNIT COSTS BY DEPARTMENTS

For the Fiscal Year Ended October 31, 19—

			Quantity Processed (in thousands)	Total Cost	Unit Cost
Quarrying transfer to Pans and Machines			18,000	$ 24,300.00	$ 1.35
Spoiled in pans and machines			400		
Cost of good bricks transferred to Pans and Machines			17,600	24,300.00	1.3807
Cost of production Pans and Machines				74,275.00	4.2202
Cost of bricks put in dryers			17,600	$ 98,575.00	$ 5.6009
Inventory, November 1—bricks half-dried			50	280.00	5.60
Drying cost (Schedule 1) (17,225 M)				15,250.00	.8853
Total charges			17,650	$114,105.00	
Cost of bricks in dryers October 31			800	4,834.88	$ 6.0436
Bricks dried			16,850	$109,270.12	$ 6.4849
Bricks spoiled in drying			850		
Cost of good bricks dried			16,000	$109,270.12	$ 6.8294
Setting cost			16,000	27,750.00	1.7344
Cost of bricks set in kiln			16,000	$137,020.12	$ 8.5638
Inventory in kilns, November 1:					
Burned			200	2,950.00	14.75
Burning			100	1,020.00	10.20
Green			80	568.00	7.10
Burning cost for year (Schedule 2) (15,905 M)			...	144,225.00	9.0679
Total charges			16,380	$285,783.12	$17.4471
Bricks spoiled in burning and sold			830	2,000.00	
Cost of good bricks processed			15,550	$283,783.12	
Inventories October 31:					
Green	100,000	$ 856.38			
Burning	250,000	3,274.45			
Burned	100,000	1,763.17	450	5,894.00	
Cost of bricks unloaded			15,100	$277,889.12	$18.4032
Unloading cost				34,000.00	2.2517
General factory overhead				15,900.00	1.0530
Cost of burned bricks in yard			15,100	$327,789.12	$21.7079
Inventory, November 1			55	893.75	16.25
Total bricks available for sale			15,155	$328,682.87	$21.6881
Inventory, October 31:					
Available		15,155			
Sold		14,500	655	14,205.71	21.6881
Cost of sales			14,500	$314,477.16	$21.6881

Exhibit A
Schedule 1

CALCULATION OF UNIT CONVERSION AND TOTAL COSTS IN DRYERS

Received from pans and machines	17,600M
Inventory November 1: 50,000 half-dried, equivalent to	25M
Total handled in dryers	17,625M
Less inventory, October 31: 800,000 half-dried, equivalent to	400M
Effective production	17,225M
Cost of production	$15,250.00
Cost per M of completely dried bricks (15,250 ÷ 17,225)	$ 0.8853
Cost per M of bricks in dryers (one half complete)	$ .4427
Cost in previous departments	5.6009
Cumulative cost of bricks in dryers	$ 6.0436

Note: The above represents the number of bricks taken out of the dryers, expressed in terms of fully dried bricks. This naturally includes the spoiled bricks. If the latter were to be eliminated, the drying cost would be spread over a smaller number of bricks, thus raising the unit cost of all bricks including those still in process. As the problem specifically states that the cost of defective bricks is to be charged only against completed production in the department, it is necessary to price the work in process on the basis of the production shown in the above schedule.

Exhibit A
Schedule 2

CALCULATION OF UNIT AND TOTAL COSTS IN KILN FIRING

Quantity set in kilns		16,000M
Inventory, November 1:		
Burned: 200,000 in prior year		
Burning: 100,000 half-burnt, equivalent to		50M
Green: 80,000		80M
Total handled (green bricks)		16,130M
Inventory October 31:		
Burned: 100,000		
Burning: 250,000 (half), equivalent to	125M	
Green:	100M	225M
Effective production		15,905M
Cost of production		$144,225.00
Cost per M of completely burnt bricks (144,225 ÷ 15,905)		$9.0679
Cumulative cost of brick:		
Burned (8.5638 + 9.0679)		17.6317 *
Burning (8.5638 + 4.5340)		13.0978
Green (8.5638)		8.5638

Note: With respect to bricks spoiled in firing the same remarks apply as in drying.

TRIAL BALANCE, OCTOBER 31, 19—

Burned Bricks in Yard, Inventory:	655M at $21.6881	$14,205.71	
Burned Bricks in Kilns, Inventory:	100M at 17.6317	1,763.17	
Bricks Burning in Kilns, Inventory:	250M at 13.0978	3,274.45	
Green Bricks in Kilns, Inventory:	100M at 8.5638	856.38	
Green Bricks in Dryers, Inventory:	800M at 6.0436	4,834.88	
General Ledger			$24,934.59
		$24,934.59	$24,934.59

---

* This cost does not take spoilage into consideration.

NATIONAL SHALE BRICK COMPANY **PROCESS COST SHEET** FOR THE YEAR ENDED OCTOBER 30, 19—

	Power	General Factory Overhead	Quarry	Pans & Machines	Dryers	Setting	Kiln Firing	Unloading
Inventories, November 1					$ 280.00		$ 2,950.00 1,020.00 568.00	$ 893.75
Labor, Direct and Indirect	$ 7,000.00		$12,000.00	$36,000.00	8,000 00	$27,000.00	65,000.00	30,000.00
Materials and Supplies	5,000.00		3,000.00	15,000.00	1,500.00	750 00	3,000.00	4,000.00
Coal	6,000.00		2,000.00		5,000.00		55,000.00	
Royalties			6,300.00					
Insurance		$ 2,500.00						
Taxes		3,000.00						
Depreciation	1,750.00	400.00	1,000 00	5,500.00	750.00		26,250.00	
Superintendence		10,000.00						
Coke Sales							(7,000.00)	
Spoiled Brick Sales							(2,000.00)	
Service Department Distributions:								
Power	$19,750.00			17,775.00			1,975.00	
General Factory Overhead		$15,900.00						15,900.00
Process Costs and Transfers:								
1. **Quarry** (18,000,000 bricks at $1.35) (Exhibit A)			$24,300.00	24,300.00				
2. **Pans and Machines** (17,600,000 bricks at $5.6009) (Exhibit A)				$98,575.00	98,575.00			
3. **Dryer** (17,650,000 bricks)					$114,105.00			
to Setting Dept. (16,850,000 bricks at $6.4849) (Exhibit A)					$109,270.12	109,270.12		
Inventory (800,000 bricks at $6.0436) (Schedule 1)					4,834.88			
					$114,105.00			
4. **Setting** (16,000,000 bricks at $8.5638) (Schedule 2)						$137,020.12	137,020.12	
5. **Kiln Firing** (15,550,000 bricks)							$283,783.12	
to Unloading Dept. (15,100,000 bricks at $18.4033) (Exhibit A)							$277,889.12	277,889.12
Inventory at October 31, 19—								
Burned (100,000 bricks at $17.6317) (Schedule 2)							1,763.17	
Burning (250,000 bricks at $13.0978) (Schedule 2)							3,274.45	
Green (100,000 bricks at $8.5638) (Schedule 2)							856.38	
							$283,783.12	
6. **Unloading** (15,155,000 bricks at $21.6881) (Exhibit A)								$328,682 87
Cost of Sales (14,500,000 bricks at $21.6881)								$314,477.16
Inventory (655,000 bricks at $21.6881)								14,205.71
								$328,682.87

Process Cost Reports and Statements. In industries where operations are repetitive and continuous, unit costs ought to exhibit a high degree of stability. Variations in costs are therefore an indication of the presence of factors out of the ordinary. Accordingly, cost variations are looked for and the reasons for them investigated. Process costing permits easy computation of costs as often as desired, the frequency depending on the type of industry, the rapidity of inventory turnover, and the length of the manufacturing cycle. Where there are no process inventories or where a manufacturing cycle is completed in twenty-four hours, daily reports are the rule. Thus, for example, bakeries and dairies make use of daily summaries accounting for quantities and values of the different products. These daily reports lend themselves to easy summarization on weekly, semimonthly, or monthly statements.

The form and content of these monthly operating statements depend on the nature of the industry, size of plant, and the degree to which management is aware of the need for information in controlling its operations. The statements usually include information concerning

1. Quantities processed
2. Analysis of total and unit costs by
   a) Products
   b) Elements of cost
   c) Departments or processes
   d) Or by any combination of the above

Thus, for example, the production cost summary of manufactured bricks on page 124 shows in parallel columns the quantities processed, total costs, and unit costs. These data are subdivided by processes which in turn reveal costs by elements.

QUESTIONS

1. What type of manufacturing activity would suggest the use of a process cost system?
2. List the conditions essential for the use of a process system.
3. An inherent weakness in process cost methods is evident in the approach to inventory valuation. Explain.
4. What quantitative information is essential to an end-of-period determination of unit costs in a process system?
5. Compute the equivalent production for material and labor and manufacturing overhead using (*a*) the incompleted units method, and (*b*) the completed units method in the following case:

Inventory, March 1, 19—	400 units (30% complete)
Placed into production	6000 units
Sent to next process	5500 units
Inventory, March 31, 19—	700 units (40% complete)

Material was added at the beginning of the process, labor and manufacturing overhead uniformly through the process.

6. List the steps required in closing process accounts.
7. Many accountants spread the cost of shrinkage over the number of good units completed as derived from a computation of equivalent production. With regard to the partially completed goods in process does this not tend to charge these goods with shrinkage twice, once during the current month and once again next month when the goods are finally finished? Discuss.
8. Discuss the effect of the treatment of spoilage by neglect on units costs and inventory values.
9. *a*) Explain the difference in the treatment of spoilage when it occurs during the process and when it occurs at the end of the process.
   b) Compare the effect of this treatment on unit cost of production and value of ending goods in process.
10. Process cost accounting is based upon average costing. Herein lies its most important weakness. Explain.
11. The Expansive Construction Company contracted to build 100 railway cars of the same type for $2,500 each, payable as the cars were delivered. At the date of audit construction costs of $199,500 had been charged to contract work in process and 75 of the units had been delivered and charged to the customer. The remaining 25 units were alleged to be 80% complete.
    a) Outline a program for verification of the balance in the contract work in process account.
    b) Indicate how the above data should be shown on the balance sheet.

Chapter 7

MATERIAL CONTROL—ORDERING AND RECEIVING

Materials Terminology. Cost accounting terminology commonly distinguishes several classes of items which are similar in the problems of accounting and control which they present. They are generally referred to as raw materials, supplies, finished parts, and purchased parts.

Since these items are ordinarily kept in stock in a storeroom, they are commonly and collectively referred to as *stores.* For greater clarity, cost accountants differentiate between raw materials stores, finished parts stores, and finished goods stores.

1. *Raw Materials.* Raw materials may be defined as commodities which will be consumed or changed in form during the manufacturing process in the purchaser's plant. Pig iron, wheat, fat steers, coal, and lumber are raw materials in that they supply the basis for manufacturing operations in well-known industries. Raw materials may be subdivided as follows:

- *a*) *Direct materials* are materials which can be specifically charged to production orders or to any class or type of product. They usually form a part of the finished product and include boxes and containers into which the products are packed. Material is direct only if it can conveniently and definitely be identified with or charged to a particular product, job, or process. If it cannot conveniently or economically be charged in this way, it should be classed as an indirect material to be spread over production on some logical basis.
- *b*) *Indirect materials* are materials of a general character, no matter how essential to production, which cannot be definitely assigned to a job or process. Indirect materials are therefore materials used in production but not readily assignable to a given process, job, or product.

2. *Supplies.* Supplies include material used in production; they are classified into a number of functional groups, such as factory supplies, office supplies, delivery supplies, packing and shipping supplies.

a) *Factory supplies* are consumed in the factory in the process of production but are not physically incorporated in the product. They include such items as oil, grease, and waste for machines; brooms, rags, and cleaning materials for janitors. The accounting treatment of indirect materials and factory supplies is identical; in practice many companies use the terms "indirect material" and "factory supplies" synonymously.

b) *Office supplies* include such items as paper, pencils, stationery, business forms, stencils, carbon paper, and ink. Those office supplies used in connection with the accumulation of manufacturing cost data may be classed as factory office supplies. Other office supplies used are charged to selling and administrative expenses.

c) *Delivery, packing, and shipping supplies* include such items as wrapping paper, tags, twine, glue, cartons, boxes, packing and crating materials. In most cases these supplies when used are classed with selling expense.

3. *Finished Parts.* Finished parts are materials which enter into the product but which were previously manufactured and stored temporarily for subsequent use in completing the finished product. Finished parts are therefore direct materials when re-entering the productive stage on an assembly order. They may also be sold as replacement parts.

4. *Purchased Parts.* Purchased parts are acquired from other companies and are assembled into a finished product. Many concerns operate as assembly organizations, purchasing parts from others, while other companies purchase some individual parts which they are not equipped to produce and combine them with their own products. Such purchased parts, when acquired from an independent company or a separate manufacturing division of the same company, are properly treated as direct material costs of the purchasing company or division.

Importance of Control over Materials. The materials used in a factory are valuable, for if one examines the balance sheets of manufacturing companies it is often found that the inventories represent assets of considerably more value than does the cash on hand and in the bank. While most companies take great care to safeguard cash it is not uncommon to find materials of even greater value handled almost without precaution. Many materials can be damaged by exposure to weather, others become obsolete or spoil if not used promptly, many materials can be lost by theft, and all can be wasted through careless usage. Inaccurate accounting for material costs also destroys the accuracy of the final product cost. All these factors make it imperative to exercise control over the handling of materials.

An effective plan of control offers the following advantages:

1. Minimizes waste in the usage of materials and supplies
2. Reduces risk of losses from fraud and theft
3. Reduces the amount of capital tied up in inventories
4. Reduces the investment in buildings and equipment used for storage of materials
5. Avoids delays in production arising from lack of materials at the time they are needed
6. Provides more accurate product costs
7. Facilitates the preparation of accurate financial statements both monthly and annually

Nature of Material Control. The establishment of control over materials has essentially a twofold aspect:

1. Physical protection against loss from deterioration and pilferage
2. Keeping of records to establish accountability for materials on hand and provide information with respect to what has been received, what has been used, and what is on hand together with the costs

Physical protection of materials takes the form of providing a storeroom or other suitable place to keep the materials. Storage facilities must, of course, be adapted to the needs of the materials kept in stock. Thus scrap iron or coal may be piled in the open, but machine parts may need protection from rust and perishable foods may require refrigerated storage. Arrangements must also be made to keep unauthorized persons from having access to the stored materials.

Establishing accountability for materials serves the double purpose of insuring the correct costing of materials inventories and materials used in production and of promoting managerial control over materials. Purchases and issues of materials should be made only on written orders carrying the authorization of a responsible executive. This procedure prevents waste and loss by requiring approval of someone who is in a position to decide whether or not the transaction is in the best interests of the company. In this respect transactions involving materials are not different from cash transactions, since the materials must be paid for. The creation of written records also provides sources from which entries in the books are made to record costs of materials purchased and used.

In general accounting, the cost of materials and supplies used is determined by subtracting the value of the physical inventory taken at the end of the period from the sum of the opening inventory and the purchases made during the period. This method assumes that all materials which have disappeared during the period have been used in production. It also requires a physical count of materials on hand before accurate financial statements can be prepared. This may not be practical where large and varied inventories are carried, especially if it has to be done more than once a year. Thus a medium-sized manufacturer of rubber goods normally keeps some 40,000 different items in stock, an electrical appliance factory keeps over 10,000 items, and a large public utility has over 1,000,000 items of materials and supplies in its storage warehouse and yards. To exercise control over such vast supplies and to furnish management with monthly financial statements, the factory needs perpetual inventory records of materials. To insure accuracy, these should tie in with the ledger through controlling accounts. The subsidiary ledger stock cards show what is on hand at any time and thereby facilitate the planning of production. They also provide a means whereby the material on hand can be checked against records which show what should be on hand and thus make it possible to place responsibility for inventories, particularly inventory shortages. Without such records there is no way to separate the cost of wasted or stolen materials from the cost of materials properly used. By summarizing the records of materials issued during the period, the cost of materials used in production can be obtained without a physical inventory. When many different products are made, the cost of materials used in each can be recorded and the cost of each product can be determined. This cannot be done at all without complete records of material costs. Balances in the material control accounts supply the information needed to prepare a balance sheet and income statement.

Material Handling Functions. Effective control of materials may be divided into the following functions:

1. Purchasing
2. Receiving and inspection
3. Storing and issuing
4. Record keeping

Material Purchasing Procedure

Purchasing Department. To obtain best results from the managerial standpoint, it is essential that all purchasing and receiving of materials be handled through a purchasing department under the supervision of a purchasing agent. The function of the purchasing department is to procure the materials, supplies, and equipment and to have these things on hand when they are needed. Among the functions of the purchasing department are the following:

1. To obtain and record information as to prices and sources of materials.

2. To aid in development of standard specifications for materials and supplies used by the company. This avoids the ordering of different makes, grades, and sizes of the same material, makes quantity purchases possible, reduces investment in inventories, and tends to reduce losses on obsolete materials.
3. To purchase materials, equipment, and supplies as authorized by properly approved purchase requisitions.
4. To prepare and issue purchase orders to vendors, also, if necessary, to cancel or modify original orders.
5. To secure delivery of materials when promised by maintaining a systematic follow-up of purchases and by keeping a record of all unfilled orders under contracts.
6. To verify purchase invoices to see if they agree with both purchase orders and reports of materials received as to quantity, and to determine that the prices, terms, extensions, and footings are correct.

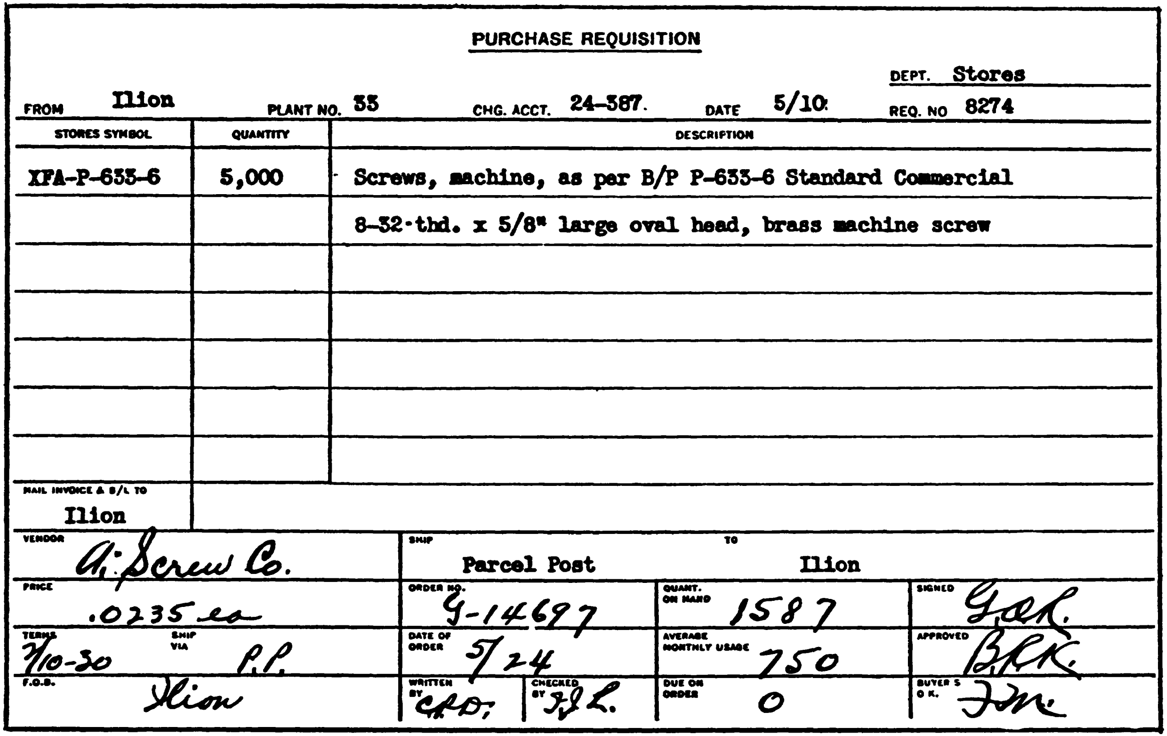
Purchasing Forms and Records. The principal forms and records used in connection with purchasing are:

1. Purchase requisition
2. Request for price quotations
3. Purchase order
4. Purchase order register
5. Receiving report
6. Inspection report
7. Returned goods report
8. Voucher charge

Purchase Requisition. The request to buy may come from any of several sources among which are:

1. Stores department, to replenish materials regularly carried in stock
2. Production department, for material which is necessary for immediate use by some department without routing such material through the storeroom
3. The production planning department, for materials which are needed for orders scheduled
4. Office manager, for supplies to be used in the offices
5. General management, for the purchase of assets such as machinery and equipment

The request to purchase should be entered on a purchase requisition, which is a form designed to provide information needed by the purchasing department (Figure 23). At least two copies are needed, the original being sent to the purchasing department while the originator retains the duplicate.



PURCHASE REQUISITION

DEPT. Stores

FROM Ilion PLANT NO. 33 CHG. ACCT. 24-387. DATE 5/10 REQ. NO 8274

STORES SYMBOL	QUANTITY	DESCRIPTION
XFA-P-633-6	5,000	Screws, machine, as per B/P P-633-6 Standard Commercial
		8-32-thd. x 5/8" large oval head, brass machine screw

MAIL INVOICE & B/L TO Ilion

VENDOR A. Screw Co.

SHIP Parcel Post TO Ilion

PRICE .0235 ea

TERMS 2/10-30 SHIP VIA P.P.

F.O.B. Ilion

ORDER NO. G-14697

DATE OF ORDER 5/24

WRITTEN BY C.A.D. CHECKED BY J.J.L.

QUANT. ON HAND 1587

AVERAGE MONTHLY USAGE 750

DUE ON ORDER 0

SIGNED G.A.K.

APPROVED B.R.K.

BUYER'S O.K. J.M.

FIGURE 23. Purchase Requisition

It is of vital importance that purchase requisitions be approved by some competent authority. It may be that the engineering department collaborating with the production division is preparing to discontinue the manufacture of certain articles, and to manufacture instead newer models which involve a complete change of specifications. Such plans are known ordinarily to only a limited number of persons in a plant; consequently all purchase requisitions must be approved by someone of this limited circle of persons in order to prevent overstocking of materials which may rapidly become obsolete.

In Figure 23, information concerning the name of vendor, price, and terms is of course inserted by the purchasing department after it has been decided who is to get the order. Information concerning quantities on hand and average monthly usage is taken from the stock ledger cards and indicates the relative urgency for the material in question. In this case, roughly a two-month supply is on hand which should be sufficient until the new material arrives.

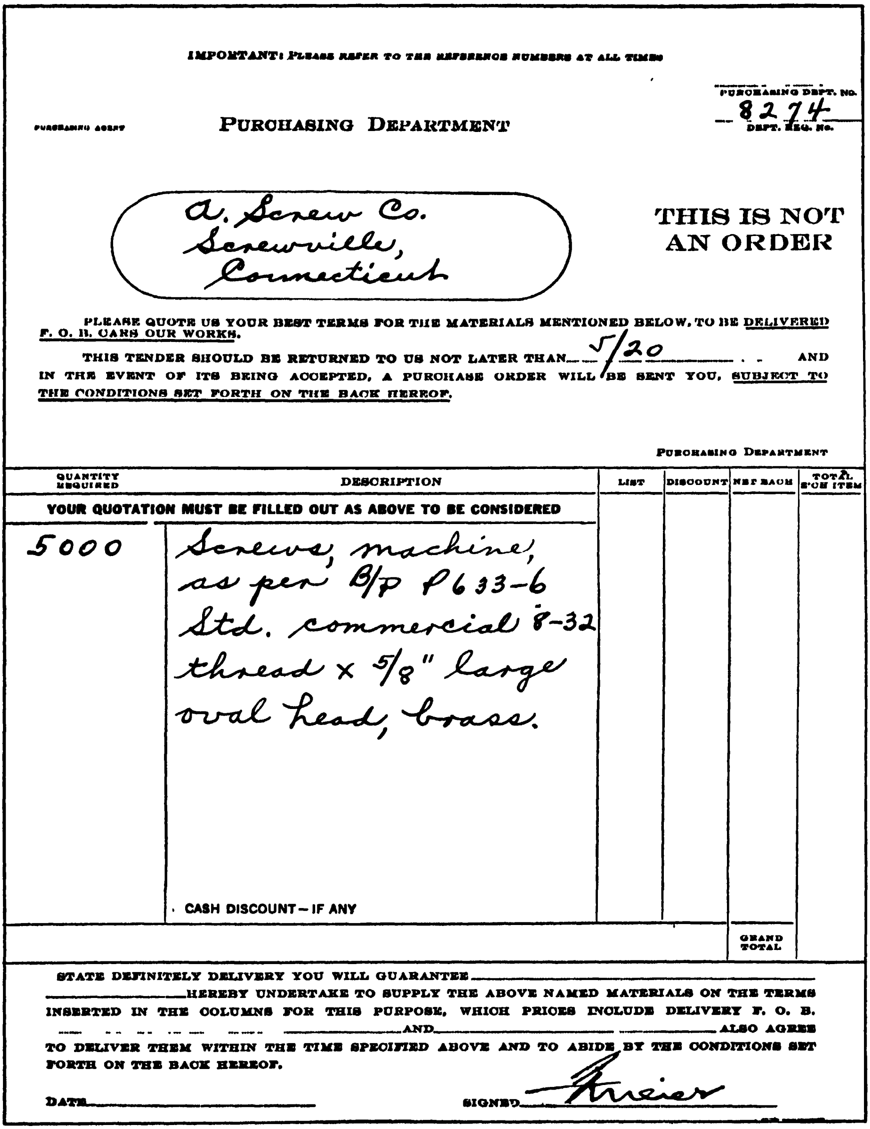
No accounting entries are necessary in connection with a purchase requisition.

Request for Price Quotations. After the purchase requisition has been received by the purchasing department, it is necessary to determine with what vendor the order shall be placed. Quality of product, price, and ability to make delivery are essential factors in selecting the proper vendor. Information is usually available in the department to aid in this selection. If the buyer is not satisfied that he has proper knowledge, requests for price quotations are sent out to various vendors (Figure 24). These requests are usually sent in duplicate to several vendors. One copy is filled in and returned and the other kept by the vendor. The advantages of such reply forms are:

1. Uniformity of quotations for tabulating and filing
2. Assurance that all points are covered in the quotation
3. Certainty that buyer's terms of purchase are either accepted or definitely rejected

Placing the Order. Orders are written on a form called a purchase order (Figure 25). This form instructs the vendor to ship the goods described on the order. It constitutes an offer to buy and, when accepted by the vendor, becomes an enforceable contract binding the buyer to pay for the goods. For this reason a purchase order should be very carefully worded in order that the terms of the contract shall represent the intent of the buyer as to description of the goods, price, terms of payment, delivery date, shipping instructions, and transportation charges.

The quantity of goods ordered must be stated plainly in figures or words or in both. Frequently clauses are inserted on the order form



IMPORTANT: PLEASE REFER TO THE REFERENCE NUMBERS AT ALL TIMES

PURCHASING DEPT. NO.

PURCHASING AGENT

PURCHASING DEPARTMENT

8274

DEPT. REQ. NO.

A. Screw Co.
Screwville,
Connecticut

THIS IS NOT AN ORDER

PLEASE QUOTE US YOUR BEST TERMS FOR THE MATERIALS MENTIONED BELOW, TO BE DELIVERED F. O. B. CARS OUR WORKS.

THIS TENDER SHOULD BE RETURNED TO US NOT LATER THAN 5/20 AND IN THE EVENT OF ITS BEING ACCEPTED, A PURCHASE ORDER WILL BE SENT YOU, SUBJECT TO THE CONDITIONS SET FORTH ON THE BACK HEREOF.

PURCHASING DEPARTMENT

QUANTITY REQUIRED	DESCRIPTION	LIST	DISCOUNT	NET EACH	TOTAL FOR ITEM
	YOUR QUOTATION MUST BE FILLED OUT AS ABOVE TO BE CONSIDERED				
5000	Screws, machine, as per B/P #633-6 Std. commercial 8-32 thread x 5/8" large oval head, brass.				
	CASH DISCOUNT – IF ANY				
				GRAND TOTAL	

STATE DEFINITELY DELIVERY YOU WILL GUARANTEE ________

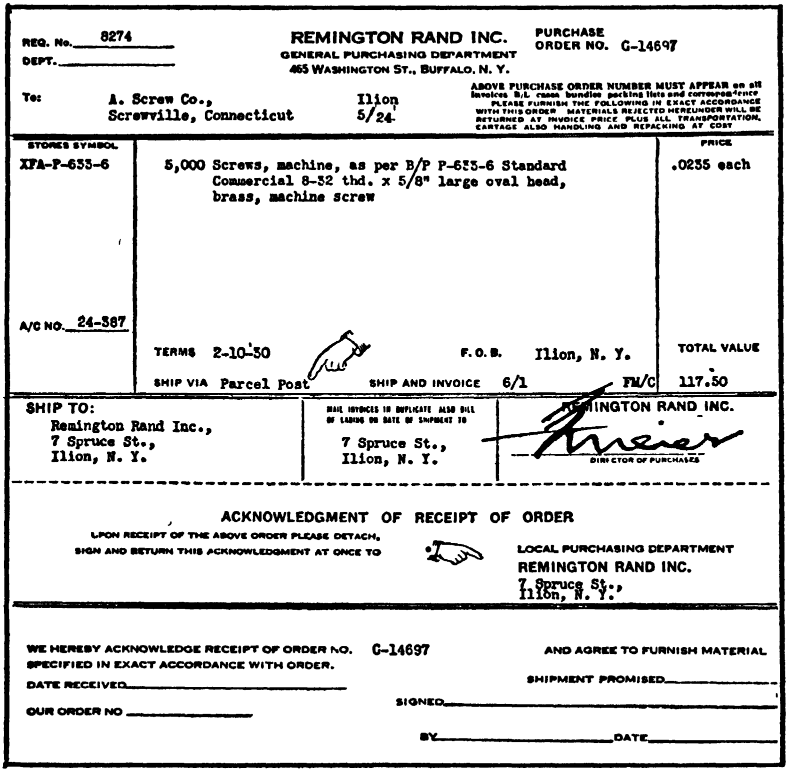
________ HEREBY UNDERTAKE TO SUPPLY THE ABOVE NAMED MATERIALS ON THE TERMS INSERTED IN THE COLUMNS FOR THIS PURPOSE, WHICH PRICES INCLUDE DELIVERY F. O. B. ________ AND ________ ALSO AGREE TO DELIVER THEM WITHIN THE TIME SPECIFIED ABOVE AND TO ABIDE BY THE CONDITIONS SET FORTH ON THE BACK HEREOF.

DATE ________ SIGNED ________

FIGURE 24. Request for Quotation

limiting the vendor's right to overship or undership the quantity ordered unless written consent of the buyer is obtained. In addition, the order must describe the goods in clear and specific terms including grade, size, and weight of material required. Clauses are often inserted allowing buyers to return goods in case of failure on the seller's part to deliver exactly the right kind. If materials are ordered subject to any unusual tests, a statement to that effect should be included on the order.

The date goods are to be shipped or delivered at the buyer's plant should be clearly stated. It appears best to indicate the date of arrival on the purchase order so that responsibility for transportation delays is shifted to the vendor. Buyers often reserve the right to cancel an order if there is default in time of delivery.



REQ. No. 8274
DEPT. ____

REMINGTON RAND INC.
GENERAL PURCHASING DEPARTMENT
465 WASHINGTON ST., BUFFALO, N. Y.

PURCHASE ORDER NO. C-14697

To: A. Screw Co.,
Screwville, Connecticut

Ilion
5/24

ABOVE PURCHASE ORDER NUMBER MUST APPEAR on all invoices B/L cases bundles packing lists and correspondence
PLEASE FURNISH THE FOLLOWING IN EXACT ACCORDANCE WITH THIS ORDER. MATERIALS REJECTED HEREUNDER WILL BE RETURNED AT INVOICE PRICE PLUS ALL TRANSPORTATION, CARTAGE ALSO HANDLING AND REPACKING AT COST

STORES SYMBOL		PRICE
XFA-P-633-6	5,000 Screws, machine, as per B/P P-633-6 Standard Commercial 8-32 thd. x 5/8" large oval head, brass, machine screw	.0235 each
A/C NO. 24-387	TERMS 2-10-30 F. O. B. Ilion, N. Y.	TOTAL VALUE
	SHIP VIA Parcel Post SHIP AND INVOICE 6/1 FM/C	117.50

SHIP TO:
Remington Rand Inc.,
7 Spruce St.,
Ilion, N. Y.

MAIL INVOICES IN DUPLICATE ALSO BILL OF LADING ON DATE OF SHIPMENT TO
7 Spruce St.,
Ilion, N. Y.

REMINGTON RAND INC.
DIRECTOR OF PURCHASES

ACKNOWLEDGMENT OF RECEIPT OF ORDER

UPON RECEIPT OF THE ABOVE ORDER PLEASE DETACH, SIGN AND RETURN THIS ACKNOWLEDGMENT AT ONCE TO

LOCAL PURCHASING DEPARTMENT
REMINGTON RAND INC.
7 Spruce St.,
Ilion, N. Y.

WE HEREBY ACKNOWLEDGE RECEIPT OF ORDER NO. C-14697 AND AGREE TO FURNISH MATERIAL SPECIFIED IN EXACT ACCORDANCE WITH ORDER.

DATE RECEIVED ____
SHIPMENT PROMISED ____
SIGNED ____
OUR ORDER NO ____
BY ____ DATE ____

FIGURE 25. Purchase Order

Shipping instructions should include the point at which goods are to be delivered, routing desired, kind of packing required, and transportation facility to be used, as express, parcel post, truck, or freight. In connection with transportation charges the f.o.b. point should be definitely stated in order to avoid disputes. This may be seller's plant, buyer's plant, or seller's plant with freight allowed. Provision should be made as to whether the seller should prepay the freight, whether it is to be paid by buyer, or whether the buyer after paying may deduct it from the invoice price.

Billing instructions should cover the number of invoices required, how invoices should be marked, and to what place they should be mailed. A typical example is: "Mail invoice in triplicate and original bill of lading to purchasing department."

Prices should be stated in the purchase order if they are based on quotations or prior agreement. This is not always possible, many prices being based on quotations on the date of shipment. Terms of payment must be definitely stated in the purchase order. They include regular cash discounts, special discounts based on quantity ordered, and special terms as to payment by acceptance or draft.

At least four copies of the purchase order are generally prepared. The original is sent to the vendor; the second is retained by the purchasing department in a file of unfilled orders and later used to check the vendor's invoice. The third copy is sent to the original requisitioner. It serves as notice to him that his requisition has been favorably acted upon. The requisitioner then fills in on his file copy of the requisition the information concerning vendor and order number. If the material ordered is kept in the storeroom, the requisitioner then turns the order over to the stock ledger clerk who records the necessary information in the "ordered" column of the proper stores ledger card. The fourth copy is sent to the receiving department where it is filed according to vendors in an "unfilled" file. Some plants prefer to block out the quantities ordered in this copy, to prevent laxity on the part of receiving clerks in counting the quantities received.

Record of Purchase Orders Outstanding. Goods on order are not included in inventories unless title has passed to the buyer. However, purchase commitments do affect the financial position of the business because a definite liability to pay will arise when the goods are sent. Hence any important amount of such commitments must be shown on the balance sheet. This may be accomplished by a footnote to the balance sheet. Another equally satisfactory method is to bring the amount of purchase commitments into the ledger before closing the books with the following adjusting entry.

Materials and Supplies on Order	$xx.xx	
Purchase Commitments		$xx.xx
To record contingent liability on purchase commitments.		

In the balance sheet the debit is ordinarily shown as part of the inventory and the credit is deducted from the inventories as a valuation account. Thus the inventory section of the balance sheet might appear as follows:

Materials and Supplies Inventory (including materials and supplies on order amounting to $xx)	$xx.xx	
Less: Purchase Commitments	$xx.xx	$xx.xx

The above adjusting entry is reversed at the beginning of the next period since its only purpose is to bring into the ledger the amount of the purchase commitments outstanding at the balance sheet date.

Some companies keep a memorandum record in which purchase orders are listed as issued; others use the file of duplicate copies of the purchase orders as a record of purchase orders outstanding.

Receiving and Inspection

Functions of Receiving and Inspection Department. The functions of the receiving and inspection department are:

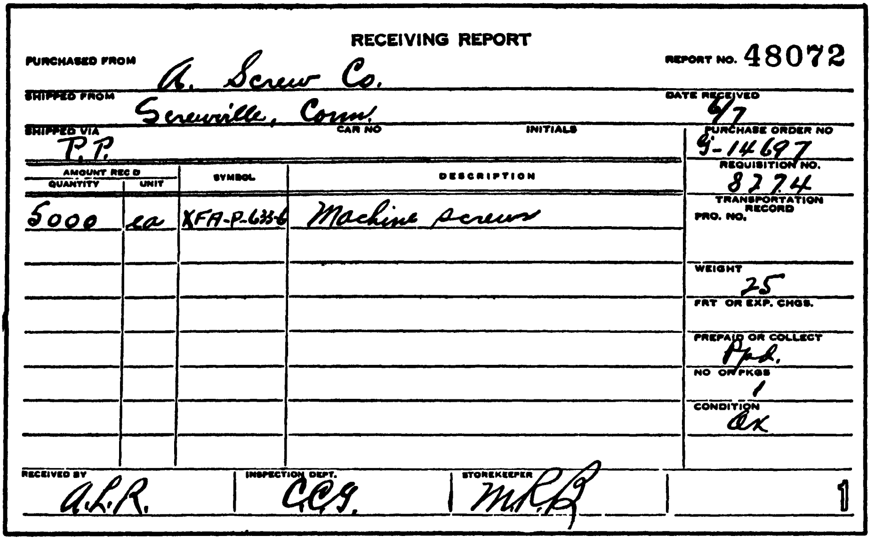
1. To receive all incoming raw materials and supplies from various transportation agencies, properly signing for the same
2. To verify items received by count, weight, etc., reporting all shortages
3. To inspect materials and supplies as to quality
4. To deliver goods received to the proper point in the plant for storage except where a material handling department performs this function
5. To inform the purchasing department of all facts that may require adjustment with vendor

Upon receipt of the goods the receiving clerk makes out a receiving report. Figure 26, in addition to being a receiving report, is also used to record the results of inspection of the goods received.

Four copies of the receiving report are needed. The first accompanies the goods when sent from the receiving department to the materials stockroom; here it is receipted and returned to the receiving department's files. The second copy is sent to the purchasing department where it is compared with the purchase order and invoice to make certain that the goods ordered and charged for by the vendor have been received. The third copy is sent to the accounting department where it is used to support the voucher for the invoice. The fourth copy goes to the stores ledger clerk and from it the materials received are entered in the "receipts" column of the proper stores ledger cards.

If the receiving department is required to inspect or test incoming materials, the results of such inspection or testing should be reported to the purchasing department. In large companies special inspection reports are used, their form depending on the nature and extent of the inspection tests performed.

If, after inspection, the materials are rejected, the inspector's report should show in detail the reasons for rejection, so that the purchasing department or claim clerk may act intelligently in making an adjustment with the vendor.



RECEIVING REPORT

PURCHASED FROM A. Screw Co.

REPORT NO. 48072

SHIPPED FROM Screwville, Conn.

DATE RECEIVED 6/7

SHIPPED VIA P.P.

CAR NO

INITIALS

PURCHASE ORDER NO 9-14697

REQUISITION NO. 8774

AMOUNT REC'D QUANTITY	AMOUNT REC'D UNIT	SYMBOL	DESCRIPTION
5000	ea	XFA-P-6336	Machine screws

TRANSPORTATION RECORD

PRO. NO.

WEIGHT 25

FRT OR EXP. CHGS.

PREPAID OR COLLECT Ppd.

NO OF PKGS 1

CONDITION OK

RECEIVED BY A.L.R.

INSPECTION DEPT. C.C.G.

STOREKEEPER M.R.B.

1

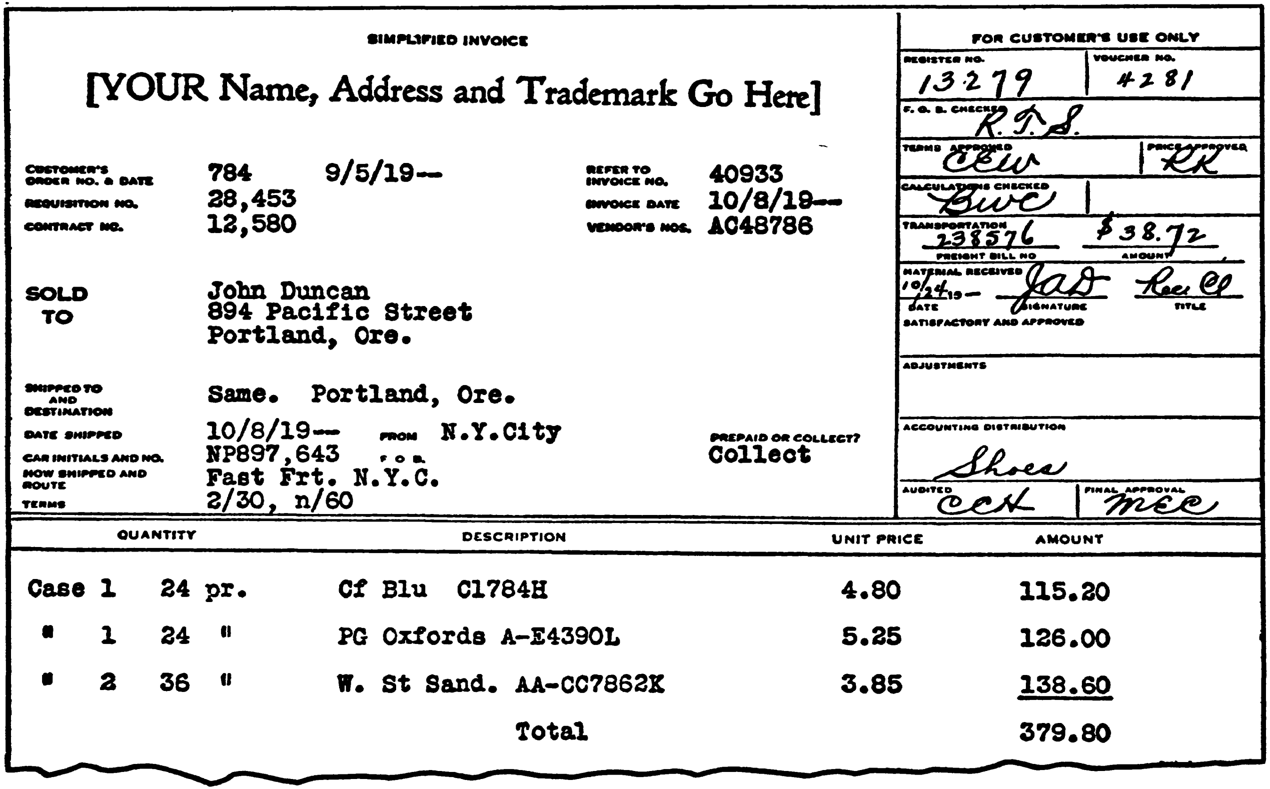
Figure 26. Receiving Report

Accounting for Materials Received. When materials are received, accounting entries must be made to debit the materials purchased to the proper asset accounts, such as Stores or Plant and Equipment. In addition they must also be entered on the proper stock ledger cards or equipment ledger. Finally, it is necessary to record the liability for goods purchased. This is evidenced by a purchase invoice based upon the purchase order and is the vendor's charge for material supplied. The form of the invoice is usually determined by the vendor. Some vendees furnish their own form for billing which is sent with the purchase order.

When an invoice is received, a rider is attached or the invoice is rubber-stamped to show the order in which it is to be routed to the various departments for necessary approval and checking. A typical stamp on an invoice includes the following:

1. Cash discount terms. . .
2. Entered on purchase record .
3. Approved for price . . .
4. Buyer's approval . .
5. Date received in plant. . . . .
6. Receiving report No. . . . .
7. Date of receipt of goods. . . . . . .
8. Accounting department O. K.
9. Charge to . . . .
10. Date paid . . . .
11. Check No. . . . .

A standard or uniform invoice has been devised by the National Association of Purchasing Agents (Figure 27). Use of such an invoice saves time in auditing and also obviates the necessity for a rubber stamp since spaces are provided on the form for checking purposes.



SIMPLIFIED INVOICE

[YOUR Name, Address and Trademark Go Here]

CUSTOMER'S ORDER NO. & DATE 784 9/5/19—
REQUISITION NO. 28,453
CONTRACT NO. 12,580

REFER TO INVOICE NO. 40933
INVOICE DATE 10/8/19—
VENDOR'S NOS. AC48786

SOLD TO
John Duncan
894 Pacific Street
Portland, Ore.

SHIPPED TO AND DESTINATION Same. Portland, Ore.
DATE SHIPPED 10/8/19— FROM N.Y.City
CAR INITIALS AND NO. NP897,643 F.O.B.
HOW SHIPPED AND ROUTE Fast Frt. N.Y.C.
TERMS 2/30, n/60

PREPAID OR COLLECT? Collect

FOR CUSTOMER'S USE ONLY
REGISTER NO. 13279
VOUCHER NO. 4281
F.O.B. CHECKED R.T.S.
TERMS APPROVED CEW
PRICE APPROVED RK
CALCULATIONS CHECKED BWC
TRANSPORTATION 238576 FREIGHT BILL NO $38.72 AMOUNT
MATERIAL RECEIVED 10/24 19— DATE JAD SIGNATURE Rec Cl TITLE
SATISFACTORY AND APPROVED
ADJUSTMENTS
ACCOUNTING DISTRIBUTION Shoes
AUDITED CCH
FINAL APPROVAL MEE

QUANTITY			DESCRIPTION	UNIT PRICE	AMOUNT
Case	1	24 pr.	Cf Blu C1784H	4.80	115.20
"	1	24 "	PG Oxfords A-E4390L	5.25	126.00
"	2	36 "	W. St Sand. AA-CC7862K	3.85	138.60
			Total		379.80

FIGURE 27. Uniform Invoice

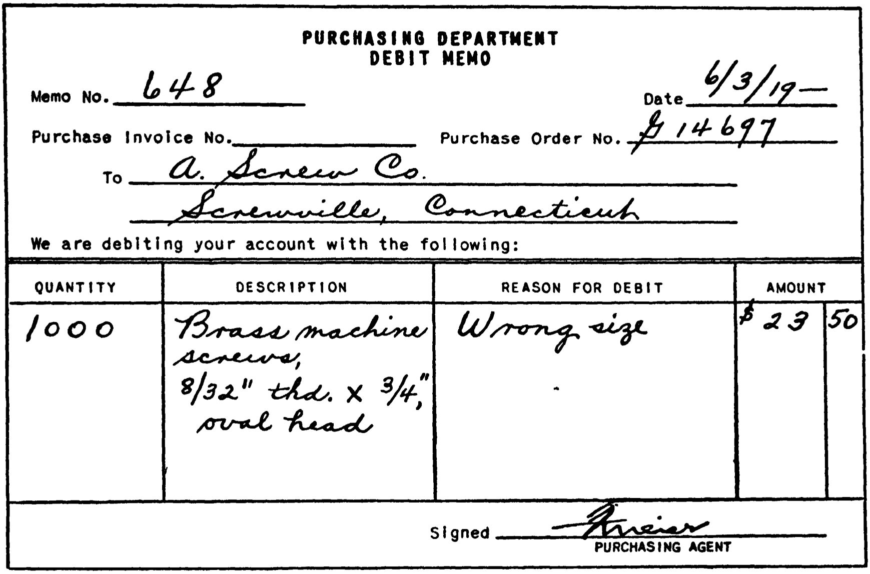
Before the invoice is approved for payment, it must be checked against both the receiving report and the purchase order. These functions are often performed in the purchasing department although in some companies the work is done in the accounting department. The following points should be kept in mind:

1. *Quantity* must be checked against the purchase order to guard against over and under shipments; also against the receiving report to prevent payment for goods not received.
2. Where necessary, the *quality* of goods received is determined by the inspection department, and in such cases its approval is a prerequisite to the passing of the invoice by accounting department.
3. *Unit prices* should be checked by the purchasing department through the use of quotation records, catalogs, etc.
4. *Extensions and footings* are checked usually with the aid of calculating machines.
5. *Terms and discounts* available should be carefully checked. Cash discounts that may be secured should be on file in the department responsible for paying invoices.
6. All *transportation charges* should be checked by the purchasing department and finally sent to the traffic department for approval as to the rate.

In connection with the handling of invoices, the accounting department must see that the correct amounts are charged to the proper account or accounts, and that the work of the purchasing department is adequately checked. The latter is necessary to prevent errors and dishonesty.

Accounting Entry for Goods Received. When the invoice has been checked and approved, the accounting department prepares a voucher. Entry of the transaction is then made in the voucher register. A debit for the materials is entered in the stores or other suitable column and the corresponding credit is placed in the vouchers payable column. If more than one material cost control account is kept, the debit must be properly divided. Thus, if separate accounts are kept for raw materials and supplies there should be a debit column in the voucher register for each of these two accounts.

Purchase Returns and Allowances. Goods may be returned to the vendor for credit or allowances may be claimed because of shortages, incorrect charges, etc. A debit memo (Figure 28) is used to notify the vendor and to serve as a record of the transaction. A copy of the debit memo is attached to the voucher in support of the deduction from the amount of the vendor's invoice. Ordinarily the voucher is drawn for the amount owing the vendor after subtraction of the allowance.



PURCHASING DEPARTMENT
DEBIT MEMO

Memo No. 648 Date 6/3/19—

Purchase Invoice No. ______ Purchase Order No. G 14697

To A. Screw Co.
Screwville, Connecticut

We are debiting your account with the following:

QUANTITY	DESCRIPTION	REASON FOR DEBIT	AMOUNT	
1000	Brass machine screws, 8/32" thd. x 3/4", oval head	Wrong size	$ 23	50

Signed ______
PURCHASING AGENT

FIGURE 28. Purchase Department Debit Memo

Accounting for Partial Shipments on Purchase Orders. For various reasons a vendor does not always ship the entire amount ordered. He may be temporarily out of certain items, or a year's supply may have been ordered at one time, with the request that shipments be made in monthly instalments. When partial shipments are received, the usual accounting procedure may be followed; that is, a voucher is made out for the amount received debiting Stores and the proper stores cards, and crediting Vouchers Payable. Vouchers for these partial shipments are approved and paid regularly to take advantage of all discounts allowed. In connection with partial shipments notations are made by the purchasing agent and the receiving clerk on their respective copies of the purchase order, and these copies are kept in the active file until all goods are received.

Determining Cost of Purchased Materials. The cost of purchased materials, as shown on stores ledger cards, properly includes all costs incurred in getting the materials to the point where they are used. To the invoice price the costs of purchasing, transportation, receiving, inspection, and storing may be added. Against these cumulative charges may be set a deduction for whatever discounts may be available. This means that in effect what are normally considered as period charges are being converted into product charges. That is, instead of writing off to profit and loss such items as inward freight and departmental expenses mentioned above, they are capitalized by charging them to inventory. This naturally produces a different net profit figure. The question is one of determining the true cost of the inventory by following to its logical conclusion the generally accepted accounting principle that the cost of purchased material is the cost delivered to the plant, ready for production or sale. It is to be noted that whatever method is adopted produces an effect on the unit cost of the material. For example, an invoice for 1,000 units at an invoice price of $1 per unit and subject to a discount of 2/10 n/30 may result on the stock record in a cost of $1 or $.98 per unit depending upon the method used.

Customs Duties. After the net invoice price of material purchased is computed, the next step is to build up the cost to take account of a variety of factors commonly associated as part of the cost of acquiring material. The first of these represents custom duties in the case of imported material. Since the duties paid can in every instance be associated with specific tariff schedules on specific items appearing on the invoice, it is a relatively simple matter to adjust the cost on the invoice by the amount of duties paid and to adjust the unit cost on the stock ledger card accordingly.

Transportation Charges. Transportation costs have generally been recognized as proper additions to the cost of purchased materials. Such transportation charges include freight, express, parcel post, and trucking. Where only one item appears on an invoice, the problem is simple. All that is required is to add to the net invoice price a transportation charge after the invoice has been duly audited by the traffic department. The resulting total is then divided by the number of units purchased and the unit cost entered on the stores ledger card. In recording the transportation charge, Stores account is debited instead of Inward Freight and Cartage in order to secure agreement of the subsidiary record with the controlling account.

Where two or more items appear on an invoice, it is necessary to prorate the transportation charges to each item. This may be done on the basis of established rate schedules of the transportation agency, or it may be done without reference to any such schedule by apportioning the charge on the basis of weight, volume, or value. The latter is perhaps the most common since it is the most readily available method. It is because of the practical difficulties described above that some concerns charge transportation costs on incoming materials to manufacturing overhead and distribute the latter to production as an indirect expense, usually on the basis of quantity or cost of material used.

Material Burden. The above-mentioned charges and credits covering transportation charges and discounts can, in one way or another, be associated with specific items on an invoice. However, the costs of purchasing, receiving, inspection, and storing can seldom be allocated to specific kinds of materials. Hence, as a practical matter, these costs are usually charged to manufacturing overhead rather than to stores inventory accounts. An alternative to this method is to reduce the above costs to a flat charge in the form of a so-called material overhead or burden rate. Such a charge represents an estimate of the costs of operating these departments. It consists of converting the expenses to a rate usually in the form of a percentage of the total invoice amounts handled during a given period. For example, investigation may show that in a normal month invoices received totaled $100,000; also that the normal expenses of operating the above departments amounted to $5,000 per month. The rate would, therefore, be 5% of the invoice price; hence after all the direct charges have been allocated to the invoice items, a flat 5% would then be added to the cost of each item on the invoice to represent the material burden. The resulting accounting procedure is interesting. Assume, for example, the following situation taken from details in Figure 27:

1. Invoice	$379.80
2. Terms	2/30 n/60
3. Transportation	$ 38.72

The item might then be recorded as follows (expressed in journal form):

OCTOBER 25

(1)

Stores	$372.20	
Vouchers Payable		$372.20

To record voucher No. 4281 at net invoice price of $379.80 less 2%.

(2)

Stores	$ 38.72	
Vouchers Payable		$ 38.72

To record freight bill No. 238576 applying on voucher No. 4281.

(3)

Stores	$ 18.99	
Applied Material Handling Expense		$ 18.99

To record 5% material handling charge on $379.80.

The detailed stores records must be posted on the basis of the following analysis (it is assumed that transportation is apportioned on the basis of total value of products):

Quantity	Item	Invoice	(Cr.) Discount	Transportation	Material Handling Expense	Total	Unit Cost
24 pr.	C 1784 H	$115.20	$2.30	$11.74	$ 5.76	$130.40	$5.4333
24 "	A 4390 L	126.00	2.52	12.85	6.30	142.63	5.9429
36 "	A 7862 K	138.60	2.78	14.13	6.93	156.88	4.3578
		$379.80	$7.60	$38.72	$18.99	$429.91	–

The unit cost columns on the respective stock ledger cards will show the figures contained in the last column of the above analysis.

A further entry is required at the end of the month. This is to gather into one account the expenses of operating the material handling departments whose totals have been built up during the month from various sources.

OCTOBER 31

(4)

Material Handling Overhead	$5,000.00	
Purchasing Department Overhead		$2,000.00
Receiving and Inspection Department Overhead		1,000.00
Stores Department Overhead		2,000.00
To record actual material handling expenses.		

The above figures representing the expense of operating these departments should theoretically balance against the applied material burden. Such hardly ever is the case. The reasons are twofold: First, the volume of invoices on which 5% was taken may be larger or smaller than normal. Second, the expense of operating the material handling departments may be greater or smaller than anticipated; there is, therefore, a discrepancy between the actual overhead and the applied overhead which may most easily be disposed of by being closed out to the general manufacturing overhead account.

A further alternative used by some companies because of its practical advantages involves the segregation of material handling overhead in a separate rate just as in the above case. But instead of capitalizing the material handling overhead in stores inventory it is applied directly to the jobs or processes, that is, to work in process as the materials are used. The advantage of the method lies in the fact that the materials may be recorded on the stock ledger cards at net invoice prices. Entries (1) and (2) in the previous illustration remain unchanged. Entry (3) is omitted. Instead, as materials are issued to the factory, the following entry would result:

Work in Process	$xx.xx	
Applied Material Handling Overhead		$xx.xx

Entry 4, recording the actual handling expense, would again be the same as before. The difference between the applied and actual handling expenses is disposed of as suggested earlier.

QUESTIONS

1. How is a material burden rate determined?
2. Where a material burden rate is used, indicate the effect on the statement of production cost, statement of profit and loss, and balance sheet.
3. An effective system of materials ordering and receiving should give consideration to the provision of internal check and the elimination of duplicate work. Illustrate by reference to the functions to be assigned to the purchasing, receiving, traffic, and testing and inspection departments.
4. "Material control means more paper work. After all, the material that is left is the inventory, no more, no less." In outline form indicate the advantages of inventory control as compared with the costs incurred to achieve this control.
5. *a*) The placing of a purchase order involves a legal obligation. Why is it not considered an accounting transaction?
   b) Suggest two methods for setting forth purchase commitments in the balance sheet.
6. One of the leading oil companies in this country was defrauded of close to $100,000 in the purchase of advertising printed materials. The purchasing agent in this case issued the orders and approved the bills for payment. How could such a fraud be perpetrated and how could it be avoided?
7. What documents would you look for before approving an invoice for payment?
8. Refer to Question 7 and assume that all the documents are complete in every regard and all are signed by Peter Evergood. What recommendation would you make?
9. Should the storeskeeper report to the purchasing agent, controller, or factory manager? Explain.
10. What is the relation of the purchasing department to the cost accounting department and to the general or financial accounting department?
11. A well-developed accounting system requires that receiving reports be prepared as an incident to establishing the validity of a vendor's claim for payment.

    Discuss the need for preparing receiving reports for the following purchases:

    a) Raw material
    b) Services
    c) Sundry vouchers for:
        (1) Physical examination of employees by a physician
        (2) Repairs to automotive equipment performed outside
        (3) Gasoline and oil purchased outside

(4) Professional services
(5) Laboratory and testing services
(6) Advertising
(7) Membership dues
(8) Subscriptions
(9) Garbage disposal
(10) Flowers to hospitals and funerals
(11) Repair work performed by outside companies
(12) Engraving and art work
(13) Public utilities

12. The bookkeeper of a large hardware company has made a practice of setting up raw materials and the corresponding accounts payable at the gross purchase price including trade and cash discounts. Mention (*a*) four important respects in which such a procedure might distort the company's balance sheets and (*b*) at least one way in which the operating statements based thereon would be distorted.

13. You have a client who wishes to include as a part of the cost of raw material in stores all of the cost of acquiring and handling incoming material. You are asked to:

    a) Name the principal items which may enter into the cost of material acquisition and handling.
    b) Give the arguments favoring the inclusion of these items as a part of the cost of raw material in stores.
    c) Give the arguments against the inclusion of these items as a part of the cost of raw material in stores.

14. Describe the usual documents constituting a voucher authorizing payment of amount owed for materials purchased by a manufacturing concern. What authorizations and checks would you expect to find on these documents under a proper system of internal audit?

Chapter 8

MATERIAL CONTROL—STORING AND ISSUING

Functions of Stores Department. The stores department is headed by a general storeskeeper, whose duty it is to supervise its work. Requests for purchases are initiated here, and are approved by the storeskeeper before being forwarded to the purchasing department. When goods are received, the receiving and inspection reports should have the storeskeeper's approval before being forwarded to other departments. In its handling of material and supplies, the following functions are performed by the stores department:

1. Receives and checks in all materials from the receiving department
2. Stores all goods in a proper place, clearly identified through the use of a suitable code
3. Issues materials and supplies for use upon presentation of authorized requisitions
4. Records quantities received and issued on bin tags or on stock ledger cards constituting the perpetual inventory records

The inventory records department may be a subdivision of the cost accounting department, although in many plants it is part of the stores department. In either case the operating personnel, that is, the stores ledger clerks, take complete charge of the perpetual inventory records and operate them.

While the stores ledger is a vital part of the accounting records, it also contains information which is needed daily by the stores and planning departments. When valuable and easily removable materials are kept in the storeroom, it is advisable to have the stores ledger cards kept where employees handling the materials do not have access to the cards. Otherwise, they are in a position to cover up shortages by making entries in the ledger.

In performing the above-named functions, all items received must be properly identified. This usually requires labeling or placing items in a properly tagged bin, in order to make it easier to find what is wanted at a later date and to minimize waste of time and perhaps material from issue of the wrong sizes and kinds. Again, all stores items should be stored according to requirements of the material. Lumber, coal, and sand can be piled outdoors; machined parts subject to rusting must be protected; finished textiles must be protected from dirt. In short, there must be a place for everything and everything in its place.

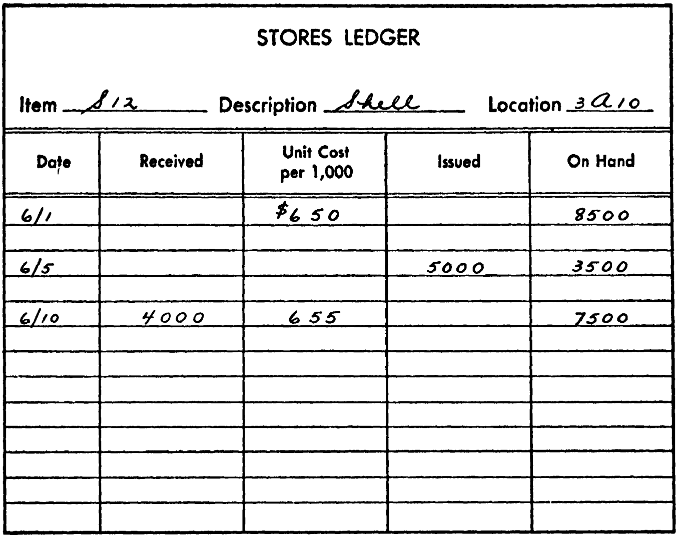
Classification and Symbolization. When many items are carried in stores, a plan of classification must be developed and symbols assigned to each item. When logical groupings into classes of materials have been made, numbers, letters, or combinations of numbers and letters are used as symbols. These symbols identify specific material items. In addition some code must be developed for locating stored items quickly and easily. Each stock ledger card usually has in addition to the material symbol a symbol indicating the stores location. This also is accomplished by use of a combination of letters and numbers. Thus, if a separate building is used as a storehouse, the symbol 2B12 might indicate that a given item is stored on the second floor, section B, bin 12. A chart or blueprint is kept handy in the storeroom showing the layout of each floor. In addition, an index may be kept by material items, showing for each the symbol and location. This greatly simplifies the task of locating specific items quickly.

Stores Records. The principal record of materials and supplies in stores is the stores ledger which constitutes a perpetual inventory of all stores, controlled by the Stores account. The stores ledger contains a separate account for each item. However, at times items of small unit value may be grouped together under a single account. Thus if wood screws of various sizes are carried in stock, a single ledger account may be kept for wood screws to avoid unnecessary detail in record keeping. Accounts in the stores ledger are usually kept on cards or sheets. In its simplest form the stores ledger card contains columns for recording *quantities* received, issued, and on hand, with auxiliary columns for date and unit price (Figure 29).

A more elaborate stores ledger card is illustrated in Figure 30. Besides containing more details under each major heading, it contains some new sections for quantities ordered, apportioned, and available. When priorities are involved or materials are required in the near future for specific production orders, apportionment is made on the stock record. The materials are still in physical possession of the storeskeeper but no longer available for other orders, and the stock card entries are made to note this situation. Some concerns attach a small *reservation card* (Figure 31) to the materials or bins to show that materials are reserved.

This prevents their issuance for other purposes. Entries on the "reserved" cards are crossed off when the goods are issued for production. Accordingly the stock ledger clerk must check both the quantity on hand as well as the quantity available. He does this through the use of two formulas:

1. Last balance on hand + Quantities received — Quantities issued = New balance on hand
2. Last balance available + Quantities ordered — Quantities apportioned = New balance available



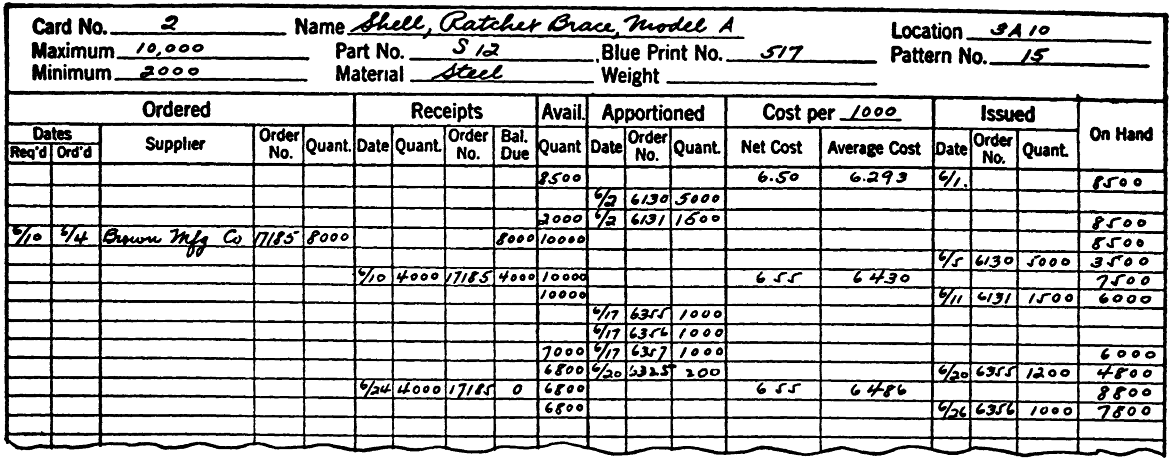
STORES LEDGER

Item S12 Description Shell Location 3A10

Date	Received	Unit Cost per 1,000	Issued	On Hand
6/1		\$6 50		8500
6/5			5000	3500
6/10	4000	6 55		7500

FIGURE 29. Simple Stores Ledger Card

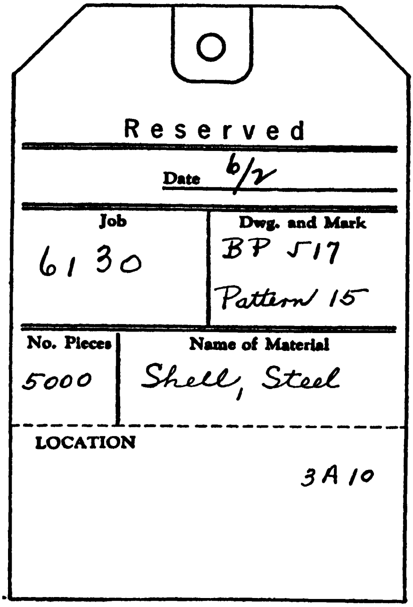
Recording Material Issues. To prevent waste and improper use of materials, no materials should be taken from the storeroom without proper authorization. Furthermore, withdrawals of materials should be permitted only on the basis of a record showing what was taken and signed by the person who authorized the use of materials. From these records posting of credits for withdrawals is made to the stock records and debits are posted to work in process accounts for the cost of direct materials used. Ordinarily the storeskeeper is held responsible for quantities of materials shown on the stock cards. He can relieve himself of that responsibility only if he can show that he received a properly authorized written order to release them. Withdrawals of materials from stores may be recorded on a stores requisition (Figure 32) or a bill of materials (Figure 33).



Card No. 2 Name Shell, Ratchet Brace, Model A Location 3A 10
Maximum 10,000 Part No. S 12 Blue Print No. 517 Pattern No. 15
Minimum 2000 Material Steel Weight

Ordered					Receipts				Avail.	Apportioned			Cost per 1000		Issued			On Hand
Dates		Supplier	Order No.	Quant.	Date	Quant.	Order No.	Bal. Due	Quant	Date	Order No.	Quant.	Net Cost	Average Cost	Date	Order No.	Quant.	
Req'd	Ord'd																	
									8500				6.50	6.293	6/1.			8500
										6/2	6130	5000						
									2000	6/2	6131	1600						8500
6/10	6/4	Brown Mfg Co	17185	8000				8000	10000									8500
															6/5	6130	5000	3500
					6/10	4000	17185	4000	10000				6 55	6 430				7500
									10000						6/11	6131	1500	6000
										6/17	6355	1000						
										6/17	6356	1000						
									7000	6/17	6357	1000						6000
									6800	6/20	6325	200			6/20	6355	1200	4800
					6/24	4000	17185	0	6800				6 55	6 486				8800
									6800						6/26	6356	1000	7800

FIGURE 30. Stores Ledger Card



Reserved

Date 6/2

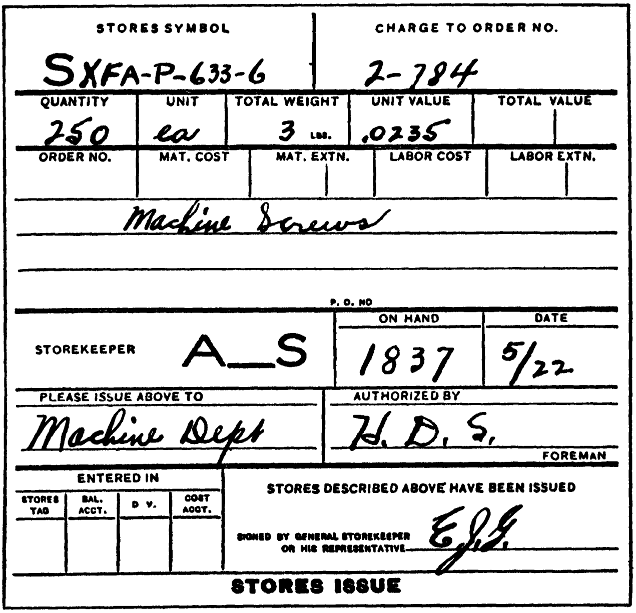
Job	Dwg. and Mark
6130	BP 517 Pattern 15

No. Pieces	Name of Material
5000	Shell, Steel

LOCATION

3A10

FIGURE 31. Material Reservation Card



STORES SYMBOL	CHARGE TO ORDER NO.
SXFA-P-633-6	2-784

QUANTITY	UNIT	TOTAL WEIGHT	UNIT VALUE	TOTAL VALUE
250	ea	3 LBS.	.0235	

ORDER NO.	MAT. COST	MAT. EXTN.	LABOR COST	LABOR EXTN.

Machine Screws

P. O. NO

STOREKEEPER	ON HAND	DATE
A—S	1837	5/22

PLEASE ISSUE ABOVE TO	AUTHORIZED BY
Machine Dept	H. D. S. FOREMAN

ENTERED IN

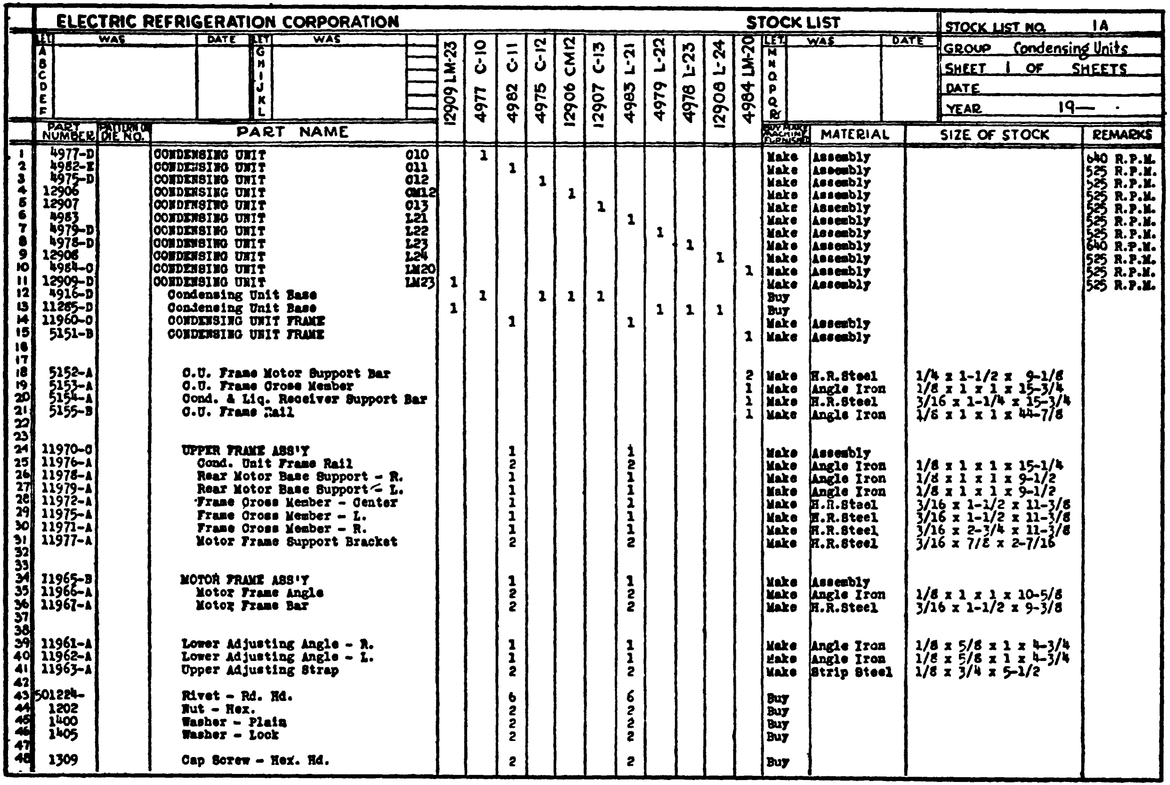
STORES TAG	BAL. ACCT.	D V.	COST ACCT.

STORES DESCRIBED ABOVE HAVE BEEN ISSUED

SIGNED BY GENERAL STOREKEEPER OR HIS REPRESENTATIVE E. J. G.

STORES ISSUE

FIGURE 32. Stores Requisition



ELECTRIC REFRIGERATION CORPORATION **STOCK LIST**

STOCK LIST NO. 1A
GROUP Condensing Units
SHEET 1 OF SHEETS
DATE
YEAR 19— .

LET. A B C D E F | WAS | DATE | LET. G H I J K L | WAS | LET. M N O P Q R | WAS | DATE

	PART NUMBER	PATTERN OR DIE NO.	PART NAME		12909 LM-23	4977 C-10	4982 C-11	4975 C-12	12906 CM12	12907 C-13	4983 L-21	4979 L-22	4978 L-23	12908 L-24	4984 LM-20	BUY MAKE MACHINE FURNISHED	MATERIAL	SIZE OF STOCK	REMARKS
1	4977-D		CONDENSING UNIT	010		1										Make	Assembly		640 R.P.M.
2	4982-E		CONDENSING UNIT	011			1									Make	Assembly		525 R.P.M.
3	4975-D		CONDENSING UNIT	012				1								Make	Assembly		525 R.P.M.
4	12906		CONDENSING UNIT	CM12					1							Make	Assembly		525 R.P.M.
5	12907		CONDENSING UNIT	013						1						Make	Assembly		525 R.P.M.
6	4983		CONDENSING UNIT	L21							1					Make	Assembly		525 R.P.M.
7	4979-D		CONDENSING UNIT	L22								1				Make	Assembly		525 R.P.M.
8	4978-D		CONDENSING UNIT	L23									1			Make	Assembly		640 R.P.M.
9	12908		CONDENSING UNIT	L24										1		Make	Assembly		525 R.P.M.
10	4984-O		CONDENSING UNIT	LM20											1	Make	Assembly		525 R.P.M.
11	12909-D		CONDENSING UNIT	LM23	1											Make	Assembly		525 R.P.M.
12	4916-D		Condensing Unit Base			1		1	1	1						Buy			
13	11285-D		Condensing Unit Base		1							1	1	1		Buy			
14	11960-O		CONDENSING UNIT FRAME				1				1					Make	Assembly		
15	5151-B		CONDENSING UNIT FRAME												1	Make	Assembly		
16																			
17																			
18	5152-A		C.U. Frame Motor Support Bar												2	Make	H.R.Steel	1/4 x 1-1/2 x 9-1/8	
19	5153-A		C.U. Frame Cross Member												1	Make	Angle Iron	1/8 x 1 x 1 x 15-3/4	
20	5154-A		Cond. & Liq. Receiver Support Bar												1	Make	H.R.Steel	3/16 x 1-1/4 x 15-3/4	
21	5155-B		C.U. Frame Rail												1	Make	Angle Iron	1/8 x 1 x 1 x 44-7/8	
22																			
23																			
24	11970-O		UPPER FRAME ASS'Y				1				1					Make	Assembly		
25	11976-A		Cond. Unit Frame Rail				2				2					Make	Angle Iron	1/8 x 1 x 1 x 15-1/4	
26	11978-A		Rear Motor Base Support - R.				1				1					Make	Angle Iron	1/8 x 1 x 1 x 9-1/2	
27	11979-A		Rear Motor Base Support - L.				1				1					Make	Angle Iron	1/8 x 1 x 1 x 9-1/2	
28	11972-A		Frame Cross Member - Center				1				1					Make	H.R.Steel	3/16 x 1-1/2 x 11-3/8	
29	11975-A		Frame Cross Member - L.				1				1					Make	H.R.Steel	3/16 x 1-1/2 x 11-3/8	
30	11971-A		Frame Cross Member - R.				1				1					Make	H.R.Steel	3/16 x 2-3/4 x 11-3/8	
31	11977-A		Motor Frame Support Bracket				2				2					Make	H.R.Steel	3/16 x 7/8 x 2-7/16	
32																			
33																			
34	11965-B		MOTOR FRAME ASS'Y				1				1					Make	Assembly		
35	11966-A		Motor Frame Angle				2				2					Make	Angle Iron	1/8 x 1 x 1 x 10-5/8	
36	11967-A		Motor Frame Bar				2				2					Make	H.R.Steel	3/16 x 1-1/2 x 9-3/8	
37																			
38																			
39	11961-A		Lower Adjusting Angle - R.				1				1					Make	Angle Iron	1/8 x 5/8 x 1 x 4-3/4	
40	11962-A		Lower Adjusting Angle - L.				1				1					Make	Angle Iron	1/8 x 5/8 x 1 x 4-3/4	
41	11963-A		Upper Adjusting Strap				2				2					Make	Strip Steel	1/8 x 3/4 x 5-1/2	
42																			
43	501224-		Rivet - Rd. Hd.				6				6					Buy			
44	1202		Nut - Hex.				2				2					Buy			
45	1400		Washer - Plain				2				2					Buy			
46	1405		Washer - Lock				2				2					Buy			
47																			
48	1309		Cap Screw - Hex. Hd.				2				2					Buy			

FIGURE 33. Bill of Material

Stores Requisition. A stores requisition (Figure 32) is a written order instructing the storeskeeper to deliver the items listed on the requisition. It is prepared by a person with authority to approve use of the material, such as a superintendent, foreman, or department or office manager. In many instances the requisitions are prepared in the production control office at the same time that production orders are being made ready for issue to the factory. When the orders are released, the requisitions are automatically sent to the storeskeeper who fills them as required.

No requisition should call for materials to be used on more than one order, since each requisition must be filed with its respective cost sheet or department. Furthermore, one requisition should not be used to get material from more than one storeroom, since each storeskeeper is required to show receipts for the issuance of material.

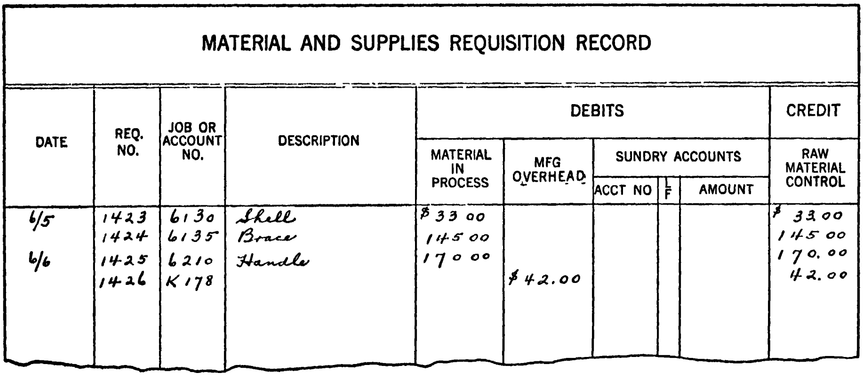
Bill of Material. The planning department or engineering department may prepare a list of the various materials and the quantities of each needed to manufacture the goods called for by a production order. This list is called a bill of materials (Figure 33) and is prepared at the time plans for manufacturing are being made. Before the factory is scheduled to begin work on the order, the bill of materials is sent to the stores department in order that it may have the necessary materials assembled and ready for use. Like a requisition, it serves as an authorization for the storeskeeper to issue the required materials. The bill of materials makes it largely unnecessary to prepare numerous requisitions. Only in case of replacements for breakage and defects are the usual material requisitions used.

Recording Issues from Stores. The stores requisition or bill of materials constitutes the original source of information for controlling stores issues. In most plants at least two copies are needed, one being kept on file by the issuing department, the other being presented to the storeskeeper and then sent on to the stores ledger clerk and the cost clerk.

When materials are issued, entries for quantities only are made on the perpetual inventory cards. Spaces on Figure 32 for unit cost and total cost are left blank to be filled in later by the stores ledger clerk. When the latter gets the requisition from the storeskeeper, he writes in the prices of materials, records the data in the "issued" and "balance" sections of the appropriate stores cards, and enters the proper information on a materials and supplies requisition record (Figure 34). This is a record which acts as a summary of materials consumed. Requisitions may be entered individually, or in summary from adding machine lists, depending upon the number of requisitions to be handled. Posting to the general ledger or factory ledger may be made directly from this record, or it may be summarized through a journal voucher as follows:

Material in Process	$xx.xx	
Manufacturing Overhead	$xx.xx	
Sundry Accounts (posted in detail)	$xx.xx	
Stores		$xx.xx
To summarize and record stores issues from —— to ——.		

The debit to the Material in Process account represents direct materials and is supported by individual entries in a work in process ledger. The debit to Manufacturing Overhead is for indirect materials and supplies. The Sundry Accounts debit takes care of such items as materials issued for use in the construction of fixed assets which must be charged to plant and equipment. Additional columns could be provided for marketing and general administrative expenses. Since the same data from the same requisitions have been entered in the control accounts and the corresponding subsidiary ledgers, the sum of the balances of the accounts in each subsidiary ledger should equal the balance of the related control account. Needless to say, postings to stores ledgers should be kept up to date in order that the ledger cards may show quantities of materials actually on hand.



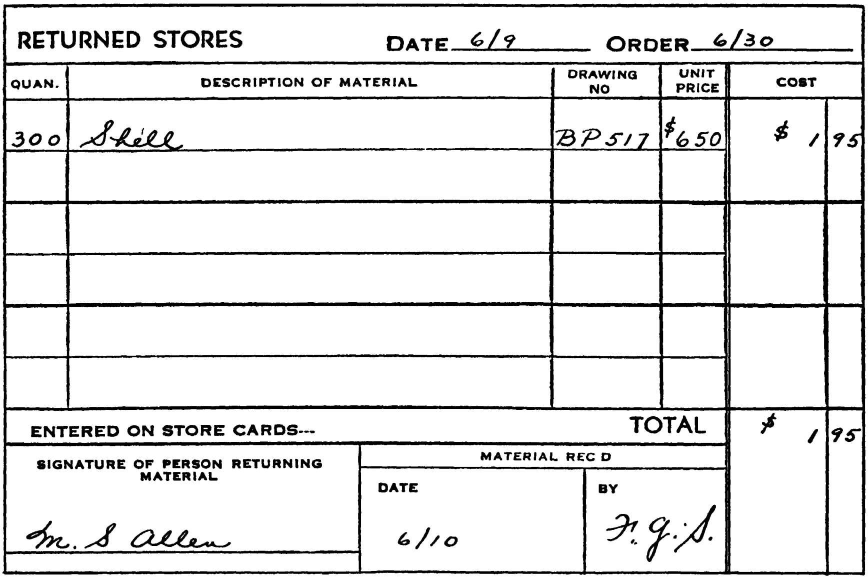
MATERIAL AND SUPPLIES REQUISITION RECORD

DATE	REQ. NO.	JOB OR ACCOUNT NO.	DESCRIPTION	DEBITS					CREDIT
				MATERIAL IN PROCESS	MFG OVERHEAD	SUNDRY ACCOUNTS			RAW MATERIAL CONTROL
						ACCT NO	LF	AMOUNT	
6/5	1423	6130	Shell	$33 00					$ 33.00
	1424	6135	Brace	145 00					145 00
6/6	1425	6210	Handle	170 00					170.00
	1426	K 178			$42.00				42.00

FIGURE 34. Materials and Supplies Requisition Record

The same requisitions, after pricing, go to the cost accounting department. Here the requisitions are first sorted into direct and indirect material classifications. The former are then sorted again by job order numbers or process accounts, depending on whether a job order or process cost system is in use. They are then posted to job cost sheets or to process accounts. The indirect material requisitions are sorted according to manufacturing overhead accounts and then posted to the proper accounts in the manufacturing overhead ledger.

Materials and Supplies Returned from Factory to Stores. At times materials and supplies may be issued in greater quantity than are needed by the factory. Any such excess should be returned to the storeroom in order that the goods may be properly cared for and accounted for. Failure to return unused materials results in inaccurate costs. The materials have been charged to the order for which they were originally issued, even though not all used. The result is that the material cost of this order is overstated. If left in the factory, the materials will likely be used for another order without recording such use. The cost of the latter order is then understated.



RETURNED STORES DATE 6/9 ORDER 6/30

QUAN.	DESCRIPTION OF MATERIAL	DRAWING NO	UNIT PRICE	COST	
300	Shell	BP517	$650	$ 1	95
ENTERED ON STORE CARDS—			TOTAL	$ 1	95

SIGNATURE OF PERSON RETURNING MATERIAL	MATERIAL REC'D DATE	MATERIAL REC'D BY
M. S Allen	6/10	F. J. S.

FIGURE 35. Returned Stores Slip

In accounting for materials returned to the storeroom, a materials and supplies credit slip (Figure 35) is prepared. The stores ledger clerk may enter the return slips in the received section of the stores cards, or in red in the issued section. In each case, the quantity and value of the return must be added to the quantity and value shown in the balance section. In addition, the return slips are sorted and entered in the appropriate column on a summary of returns to the storeroom. These slips may be entered individually, or summarized from adding machine lists, depending upon the number to be handled. Posting to the general or factory ledger accounts may be made directly from this record, or a summary may be made in the journal as follows:

Stores	$xx.xx	
Material in Process		$xx.xx
Manufacturing Overhead		xx.xx
Sundry Accounts (posted in detail)		xx.xx

Costing Stores Issues and Inventories. The procedure for controlling issues of materials through use of properly authorized requisitions or bills of materials has been described in the preceding pages of this chapter. The process of accounting for the cost of these issues remains to be explained. Different methods of pricing stores issues produce:

1. Different material costs of jobs and products
2. Different inventory values

An incorrectly priced inventory may result in a false statement of profit or loss, with injury to stockholders and others. It may produce an erroneous statement of the working capital position and thereby make a misleading impression upon the creditor. It may also result in a substantial modification of the income tax to be paid. Correct inventory valuation is, therefore, not only good cost accounting, but sound management as well.

Methods of Pricing Requisitions. Several methods of pricing requisitions are used. These are:

1. Specific cost
2. Weighted-average cost
3. Periodic average cost
4. First-in first-out (Fifo)
5. Last-in first-out (Lifo)
6. Standard cost

Specific Cost Method. In order to use this method each lot of materials purchased must be kept separate from other lots of the same material in the storeroom and a separate stores ledger card must be used for each lot. When materials are requisitioned it is then possible to determine the particular purchase and cost represented by the issued materials. This method is commonly applied to special or nonstandard materials which are purchased to fill an order which is unlikely to be repeated. It is also sometimes used for items of large unit value, particularly where each item is capable of exact identification through serial numbers or in some other way. In the latter case, the individual units may be shown on the same stock ledger card, but listed by serial numbers and stores requisitions must then identify the particular item issued by mentioning the specific serial number.

Weighted-Average Cost Method. Ordinarily it is not practical to provide storage facilities to keep various lots of the same material separated in the storeroom. Thus bolts of the same size are kept in the same bin, oil of the same type is pumped into the same tank with what remains from previous purchases, and lumber is piled with other boards of the same dimensions and grade. The average cost method is based on the theory that all the material in a given bin is so intermingled that an issue cannot be made from a particular lot, and that the cost therefore represents an average of the entire supply. By this method the average cost of each class of materials is computed and these averages are used to cost requisitions. Application of the method is illustrated in Figure 36.

Date	Receipts		Issues			Balance		
	Quantity	Unit Cost	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount
March 1						100	$1.00	$100.00
3			75	$1.00	$ 75.00	25	1.00	25.00
5	400	$1.20				425	1.18823	505.00
7			100	1.18823	118.82	325		386.18
15			50	1.18823	59.41	275		326.77
25	100	1.15				375	1.17805	441.77
27			150	1.17805	176.70	225		265.07

FIGURE 36. Weighted-Average Cost Method

To calculate the weighted-average unit cost the procedure is as follows:

1. Add quantity received to quantity on hand.
2. Add cost of material received to cost of material on hand.
3. Divide total values by total quantities.

This unit cost is used to determine the cost of materials issued until receipt of a new lot of material at a different unit cost. Then a new average cost must be computed.

In the illustration above there were 100 units in stock at an average cost of $1 each on March 1. On March 3 an issue of 75 units was made at $1. Receipt of 400 units at $1.20 each increased the quantity on hand to 425 units which cost $505 (i.e., $25 plus $480 for the additional 400 units). The new average cost is $1.18823 (i.e., $505 ÷ 425). This figure is used to cost issues until March 25 when receipt of 100 units at $1.15 makes it necessary to compute a new average cost.

The method illustrated above requires a great deal of computation when prices fluctuate frequently and purchases are numerous. The most pronounced peculiarity of the method, however, lies in the fact that the effect of a price fluctuation remains in the average even though the material which was responsible for the fluctuation has long since been issued. For example, in Figure 36 suppose that on March 28, 125 units were issued. The results would appear as follows:

225	units priced	at $1.17805	$265.07
125	" issued	" $1.17805	147.26
100	" on hand	" $1.17805	$117.81

It is to be noted that although the 100 units on hand all represent the latest batch purchased at $1.15, they are priced at the weighted average of $1.17805. The latter price reflects the high cost of earlier lots even though these have already been exhausted.

Periodic Average Cost Method. When a process cost system is used, requisitions may be held until the end of the month for costing because cost of production does not have to be determined for individual job orders. In this case a new average material cost needs to be computed only once a month instead of after each purchase. By this method material issued during the month is costed at an average unit cost which is obtained by dividing the total value of the beginning inventory and purchases for the month by the total quantity available during the month. The results are shown in Figure 37. The computation by this method is shown below:

Average unit cost of material:	
Total quantity on hand and received during March	600 units
Total cost	$695
Average unit cost $\frac{695}{600} = \$1.16$	
Cost of material issued:	
Total quantity issued during March	375 units
Total cost 375 × $1.16 =	$435

This method reduces the amount of clerical work required to compute costs of materials issued, but it adds to the peak load of accounting work which comes at the end of the month when financial statements are prepared. Some companies avoid this disadvantage by using the average calculated at the end of each month to cost all requisitions for the following month. Thus materials issued in any one month are costed at the average cost calculated at the end of the preceding month. In such cases, costing of requisitions need not be delayed until the end of the month. Using the figures in the illustration above, all materials issued during March would be costed at $1 a unit, representing the average determined at the end of February. Similarly, the April issues would be priced at $1.16, the average determined at the end of March.

Date	Receipts			Issues			Balance		
	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount
April 1							100	$1.00	$100.00
3				75	$1.16	$ 87.00	25		
5	400	$1.20	$480.00				425		
7				100	1.16	116.00	325		
15				50	1.16	58.00	275		
25	100	1.15	115.00						
27				150	1.16	174.00	225	1.16	260.00
						$435.00			

FIGURE 37. Periodic Average Method

First-In First-Out Method (Fifo). This method assumes that the various lots of a material are used in the same order in which they are received. Materials from each lot are charged out at the price at which they were originally put in stock. For this reason, the method is sometimes also called the original cost method. Application of this method to the same figures previously used is given in Figure 38. The first-in first-out method is most convenient to use when there are comparatively few purchases at different prices. When many purchases at different prices occur, it is inconvenient to keep track of the various lots.

Date	Receipts			Issues			Balance		
	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount
March 1							100	$1.00	$100.00
3				75	$1.00	$ 75.00	25	1.00	25.00
5	400	$1.20	$480.00				25 400	1.00 1.20	505.00
7				25 75	1 00 1.20	115.00	325	1.20	390.00
15				50	1.20	60.00	275	1.20	330.00
25	100	1.15	115.00				275 100	1.20 1.15	445.00
27				150	1.20	180.00	125 100	1.20 1.15	265.00

FIGURE 38. First-In First-Out Method

Last-In First-Out Method (Lifo). Under the last-in first-out method the assumption is that the last items purchased are the first used. Hence, requisitions are priced by working back from the most recent lot received; at any given time the inventory is thus assumed to be composed of the first goods purchased. An illustration of the method is given in Figure 39.

Date	Receipts			Issues			Balance		
	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount	Quantity	Unit Cost	Amount
March 1							100	$1.00	$100.00
3				75	$1.00	$ 75.00	25	1.00	25.00
5	400	$1.20	$480.00				25 400	1.00 1.20	505.00
7				100	1.20	120.00	25 300	1.00 1.20	385.00
15				50	1.20	60.00	25 250	1.00 1.20	325.00
25	100	1.15	115.00				25 250 100	1.00 1.20 1.15	440.00
27				50 100	1.20 1.15	175.00	25 200	1.00 1.20	265.00

FIGURE 39. Last-In First-Out Method

With the last-in first-out method, the cost of materials used follows the current market price more closely than when methods previously described are used. As a result, the cost of goods manufactured tends to fluctuate with the market price of materials used. However, inventories are costed at prices paid for the earlier purchases and thus they are stated at a cost which may deviate considerably from the current market value of the materials.

OPENING BALANCE SHEET

Inventory (at cost)	$100,000.00	Capital Stock	$100,000.00

CLOSING BALANCE SHEET

Inventory (at cost)	$200,000.00	Capital Stock	$100,000.00
		Retained Profits	100,000.00
	$200,000.00		$200,000.00

PROFIT AND LOSS STATEMENT

	Quantity	Unit Value	Total
Sales	100,000	$2.00	$200,000.00
Cost of Sales			
Inventory (beginning)	100,000	$1.00	$100,000.00
Purchases	100,000	2.00	200,000.00
Available for sale	200,000		$300,000.00
Less inventory (ending) (at fifo cost)	100,000	$2.00	200,000.00
Cost of sales	100,000		$100,000.00
Gross profit	100,000		$100,000.00

FIGURE 40*a*. Statements Under Fifo Method of Accounting

The basic rationale of the last-in first-out method lies in the attempt to match current costs against current revenue and also to avoid reflecting unrealized inventory profits in the accounts. The latter point may be illustrated as follows: A merchant has an inventory of 100,000 units acquired at $1 each. He sells it at $2 each, but when he comes to replace the inventory, he finds he has to pay $2 a unit. Conventional accounting procedure would result in the balance sheet and operating statement shown in Figure 40*a*. The latter shows a profit, all of it tied up in inventory. Contrast this with the situation depicted in Figure 40*b*, where current costs (replacement cost of inventory) are matched against revenues of the same period. Under the conditions shown, there is no profit.

Figure 40*b* demonstrates the application of Lifo during a period of rising prices; the effect obviously is reversed during the contraction phase of the business cycle when prices are falling. In that event, profits exceed those shown by other inventory costing procedures. A taxpayer is not permitted, however, to shop around from year to year among various methods in an effort to reduce his tax liability. Once Lifo, or any other method, is decided upon, it must be consistently applied thereafter.

In the usual application of Lifo only quantities are recorded on stores ledger cards and requisitions are accumulated and costed at the end of

OPENING BALANCE SHEET

Inventory	$100,000.00	Capital Stock	$100,000.00

CLOSING BALANCE SHEET

(Same as opening balance sheet)

PROFIT AND LOSS STATEMENT

	Quantity	Unit	Total
Sales	100,000	$2	$200,000.00
Cost of Sales			
Inventory (beginning)	100,000	$1	$100,000.00
Purchases	100,000	$2	200,000.00
Available for sale	200,000		$300,000.00
Inventory (ending) (at lifo cost) . . .	100,000	$1	100,000.00
Cost of sales	100,000	$2	$200,000.00
Gross profit	100,000		$ -0-

FIGURE 40*b*. Results of Application of Last-In First-Out Method

the period rather than on a day-by-day basis. The computation for the transactions in Figure 39 would be made as follows:

	Quantity	Unit Cost	Total
Opening inventory	100	$1.00	$100.00
Purchases (Receipts)			
First batch	400	1.20	480.00
Second batch	100	1.15	115.00
Available	600		$695.00
Issues: From last-in batch	100	$1.15	$115.00
From next to last-in batch	275	1.20	330.00
Total issues	375		$445.00
Inventory, March 31	225		$250.00

Under this method, the ending inventory is in reality made up of 125 units at $1.20 and 100 units at $1. Since pricing of requisitions must be deferred to the end of a cost period, this represents an obvious disadvantage, because of the additional work which piles up at that time. An escape from this dilemma is provided by using some other method, frequently standard costs, in day-to-day pricing of requisitions, and then using Lifo only for inventory valuation at the end of the period. This may create a discrepancy between the inventory value as determined by Lifo and the inventory value shown by the stores ledger. The disposition of such differences may be through an inventory reserve or some other method.

The basic features of the last-in first-out basis for inventory valuation have been described. Of the many variations of this method adopted by industry, the one suggested by the American Petroleum Institute contains some interesting features which can be summarized as follows:

1. Where the quantity on hand at the end of any month is not in excess of the opening inventory for the year, the closing inventory unit price will be the same as the opening inventory price. Any replacements to bring the inventory back to the level at the beginning of the year, are priced at the opening inventory price.
2. Where the quantity on hand at the end of any month exceeds the opening inventory for the year, such excess is priced at the average-to-date of the cost of goods produced or purchased.

The method is illustrated in Figure 41. The derivation of the figures for January is obvious. To arrive at the values for February it is necessary to proceed as follows:

1. Insert on the February line the production or purchases for the month indicating quantity, price, and total cost; also the quantity sold.
2. Obtain cumulative January and February totals and derive an average unit cost of $.085 ($34.00 ÷ 400).

Month	Opening Inventory Quantity	Production or Purchase			Cost of Sales			Closing Inventory		
		Quantity	Unit Cost	Total Cost	Quantity	Unit Cost	Total Cost	Quantity	Unit Cost	Total Cost
January	100	200	$ .09	$18.00	150	$ .09	$13.50	100	$ .10	$10.00
								50	.09	4.50
								150		$14.50
February	150	200	.08	16.00	175	.08074	14.13	100	.10	$10.00
		400	$ .085	$34.00	325	$ .085	$27.63	75	.085	6.37
								175		$16.37
March	175	175	.07	12.25	275	.07680	21.12			
		575	$ .08043	$46.25	575	$ .08043	$46.25			
					25	.10	2.50			
					600		$48.75	75	.10	$ 7.50
April . . .	75	225	.075	16.88	175	.07091	12.41	100	.10	$10.00
		800	$ .07891	$63.13	775	$ .07891	$61.16	25	.07891	1.97
								125		$11.97

FIGURE 41. Last-In First-Out Method (American Petroleum Institute Variation)

3. Cost the cumulative quantity sold (325) at cumulative average cost ($.085) to obtain $27.63.
4. Subtract January cost of sales ($13.50) from $27.63 to derive the cost of sales for February ($14.13).
5. Divide cost of sales for February ($14.13) by quantity sold in February (175) to get unit cost of $.08074.

The same procedure is followed each month; in March only 575 units were produced at a cumulative average cost of $.08043, however, 600 were sold; these are therefore valued as follows:

575 at $.08043
25 at $.10

The last 25 units are deemed to have been borrowed from the opening inventory for the year. When inventory once more rises to the level of the opening balance, the quantity borrowed is considered as being restored at the opening value. Accordingly, in April, 125 units are on hand at the end of the month and are valued at:

100 at $.10 (beginning inventory unit price)
25 at $.07891 (cumulative average cost)

Standard Cost Method. Another method of pricing stores issues is to set a standard cost for each material and to cost requisitions at this figure. The standard price is usually the current price at date the standard is set or the price which is expected to prevail in the coming period if a change in prices is anticipated. Standard prices are commonly brought up to date once a year. When a standard price is used, entries on stores ledger cards for receipts and issues of material are commonly kept in quantities only. Since the unit cost of materials does not change except when a new standard price is set, entry of both quantities and cost is unnecessary. The method is illustrated in Figure 42.

Standard Cost $1.15 per Unit

Date	Receipts	Issues	Balance
March 1			100
3		75	25
5	400		425
7		100	325
15		50	275
25	100		375
27		150	225

FIGURE 42. Standard Cost Method

When materials are issued, Material in Process account is debited with the quantity of material used times the standard cost per unit. The cost of materials on hand at any time is easily computed by multiplying the quantity shown in the balance column of the stores ledger card by the standard cost per unit. For example, on March 27 there are 225 units on hand which have a standard cost of $1.15 each, or $258.75 in total.

Appraisal of Methods of Costing Materials Issues. Selection of a method to be used for costing materials issues cannot be made by application of any definite rules. Instead it is largely a matter concerning which the accountant must exercise judgment in choosing a method suitable under the specific circumstances. Different methods are often applied to different materials by the same company.

Inventory and profit figures can be expected to differ somewhat depending upon the method used. If prices paid for materials change substantially during the period, a quite large difference in profits may result from the choice of one method rather than another. When prices paid for material are stable, the various methods give approximately the same results.

The following figures illustrate the divergent results obtained when changes in material prices occur:

Purchases

Month	Quantity	Price	Amount
January	1,000	$1.00	$1,000.00
February	1,000	1.05	1,050.00
March	1,000	1.15	1,150.00
April	1,000	1.10	1,100.00
May	1,000	1.30	1,300.00
June	1,000	1.25	1,250.00

If 5,000 units were put into process during the first six months the cost of the 1,000 units remaining in inventory at June 30 and the cost of the materials used are as shown below:

	Inventory	Cost of Materials Used
By average cost method	$1,141.67	$5,708.33
By first-in first-out method	1,250.00	5,600.00
By last-in first-out method	1,000.00	5,850.00

Opinions differ as to the desirability of each of the above methods. However, it is important to be consistent in following the same method each period.

Inventory Procedure

Importance of Inventories. The inventory figure which is necessary in preparing periodic financial statements may be obtained from the books, provided accurate perpetual inventory records are maintained, or by physical inventory. By physical inventory is meant the counting, weighing, measuring, listing, and valuing of goods on hand. Where perpetual inventory records are kept it is still necessary to take a physical count at certain times in order to check the accuracy of the inventory records. Some discrepancies between book records and actual quantities on hand always arise from errors, shrinkage or spoilage, and theft. These are discovered in the physical inventory and the records corrected.

Timing of Physical Inventory. The timing of physical inventories varies according to the methods of the company and the nature of its business. The inventory may be taken:

1. At the end of an accounting period, such as the end of the year. Usually the plant is shut down and all materials, supplies, work in process, and finished goods are counted and listed. This method *must* be used where perpetual inventory records are not kept.
2. Continuously, some items being counted each day. Materials, supplies, and finished goods are counted by taking sections of the storeroom in rotation; work in process is counted at the completion of each process or stage of manufacture. This method requires the use of perpetual inventory records. The physical inventory is used only as a check on the correctness of the stock records. Since all items are not counted at once, the inventory figure needed at the end of an accounting period is taken from the books.
3. At different times, such as (*a*) when a purchase requisition is made out because the quantity to be counted is then at a minimum, (*b*) according to a schedule that calls for more frequent counts of items with rapid turnover and high value and less frequent counts for less important items. In such cases perpetual inventory records are necessary to supply inventory figures without a complete physical count at the end of each accounting period.

Where there is a period of slack production and inventories are small as in the case of a canner of fruits and vegetables, the periodic physical count is preferred. In such a case, the inventory could be taken in early spring after most of the preceding year's pack has been sold and before operations have commenced on the new year's crop. In general, seasonal industries and department stores use this method. The periodic physical count is also indicated where inventories are difficult to measure as in the case of a flour mill with the problem of measuring quantities of grain in elevators subject to varying moisture content, settling, and other factors, and in the case of an oil refinery where oil in numerous tanks, to be accurately measured, must be corrected for specific gravity and temperature.

Inventory Taking Procedure. The taking of a physical inventory requires the following steps:

1. Planning
2. Preparation
3. Taking the inventory
4. Summarizing

Each business has some specific problems of its own and the detailed procedure must be varied accordingly. However, the following methods are usually applicable to a manufacturing company.

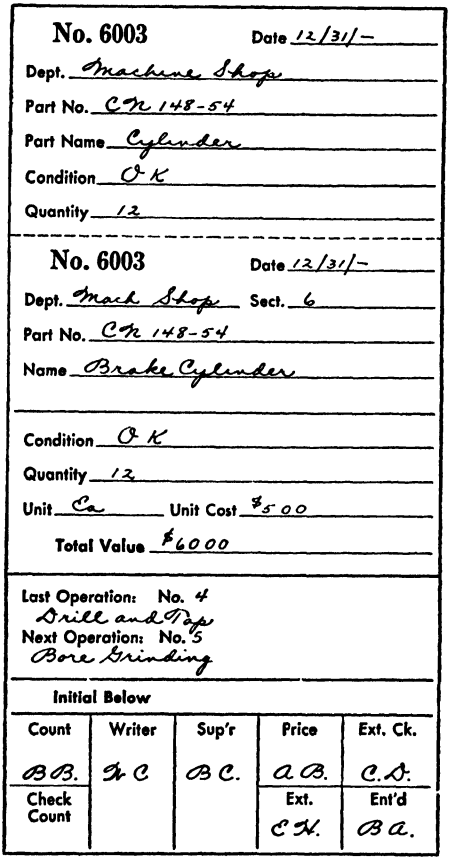
Planning for the Inventory. Planning an accurate physical inventory of a large stock of materials, supplies, and products begins with the appointment of an inventory supervisor to take charge of the task. Additional supervisory personnel is chosen according to needs. In a large company a full-time inventory staff may be maintained; more commonly the inventory organization is set up temporarily and manned by individuals chosen from the regular office and factory staff. Since much of the work is often done by employees who are unfamiliar with the methods of inventory taking and its objectives, it is important to have adequate and clearly written instructions.

Preparation for Inventory Taking. Orderly arrangement of the goods to be counted facilitates the process of inventory taking. Materials out of their proper place should be returned. Like items should be grouped together and placed where they can be readily seen and identified. Boxes, barrels, and other standard containers should be stacked in rows or piles containing uniform numbers of units so that by counting the number of piles it may be possible to determine the quantity without counting every unit. Often it is desirable to complete work in process, to collect and dispose of scrap, and to segregate obsolete materials and goods belonging to customers.

Instructions should be given to each individual who is to participate in the inventory taking. In some cases, meetings are held at which procedures are explained. Adequate supplies of forms to be used must be distributed to the places where they will be needed.

Taking the Inventory. All items comprising the inventory must be counted or measured. Ordinarily counters and recorders work in teams, one person counting and calling out the information to the recorder who writes it down.

Inventory counts are recorded on tags as shown in Figure 43. Tags are serially numbered and all numbers are accounted for to make sure that all items counted appear in the inventory summary. When a tag has been filled in by the tag writer, he tears off a stub and attaches it to the item recorded on the tag. This stub serves to indicate that the item has been counted and by matching serial numbers on stub and tag the count can be checked later on if this should be desired. A check of stock is made after counting to see that all items on hand bear tags indicating that they have been counted.



No. 6003 Date 12/31/–
Dept. Machine Shop
Part No. CN 148-54
Part Name Cylinder
Condition O K
Quantity 12

No. 6003 Date 12/31/–
Dept. Mach Shop Sect. 6
Part No. CN 148-54
Name Brake Cylinder

Condition O K
Quantity 12
Unit Ea Unit Cost $5 00
Total Value $60 00

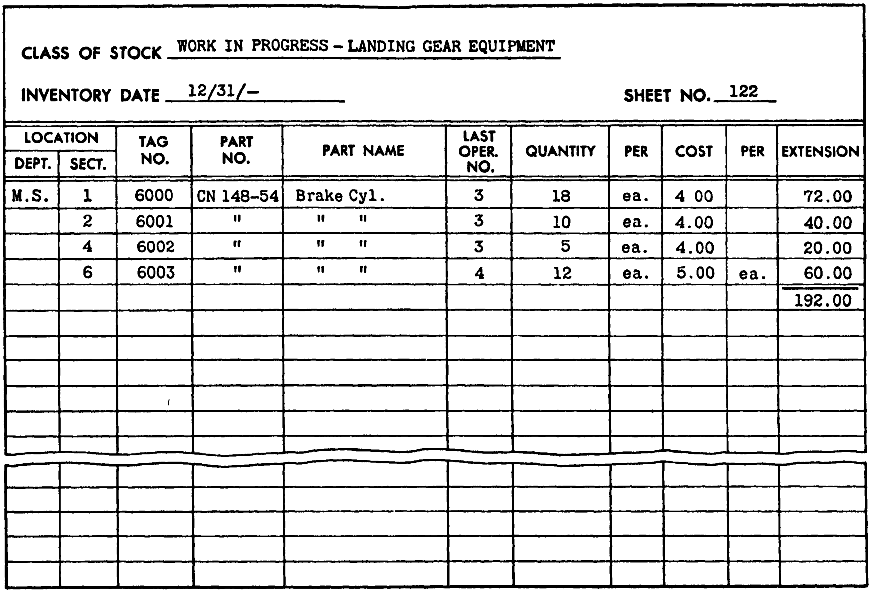
Last Operation: No. 4
Drill and Tap
Next Operation: No. 5
Bore Grinding

Initial Below

Count	Writer	Sup'r	Price	Ext. Ck.
B.B.	J. C	B.C.	A.B.	C.S.
Check Count			Ext.	Ent'd
			C.H.	B.A.

FIGURE 43. Inventory Tag

When the count is completed, the tags are collected and sorted in numerical sequence to see that all tags issued are accounted for. Next the tags are rearranged according to material classifications and the quantities and descriptions entered on inventory sheets (Figure 44).



CLASS OF STOCK WORK IN PROGRESS - LANDING GEAR EQUIPMENT

INVENTORY DATE 12/31/– SHEET NO. 122

LOCATION		TAG NO.	PART NO.	PART NAME	LAST OPER. NO.	QUANTITY	PER	COST	PER	EXTENSION
DEPT.	SECT.									
M.S.	1	6000	CN 148-54	Brake Cyl.	3	18	ea.	4 00		72.00
	2	6001	"	" "	3	10	ea.	4.00		40.00
	4	6002	"	" "	3	5	ea.	4.00		20.00
	6	6003	"	" "	4	12	ea.	5.00	ea.	60.00
										192.00

FIGURE 44. Inventory Sheet

Pricing the Inventory. The inventory manual should define cost; that is, the items to be included in cost of inventory and the basis on which it is to be determined, such as average, first-in first-out, last-in first-out, standard, or other recognized pricing methods. Where market is to be used it must be defined and the sources of information indicated. Before inventories are priced, a survey should be made to determine obsolete items and excess quantities. This is accomplished by a review of the perpetual inventory records. In addition, the counters and identifiers should be instructed to indicate on the tag or otherwise report any items not in good condition. This information should be transferred to the inventory sheets.

Overages and Shortages in Inventory. The quantities determined by physical count should be compared with balances shown on stock cards in the subsidiary inventory ledgers. When this comparison discloses differences, adjusting entries are made to bring the accounts into agreement with the actual quantities on hand. These adjustments must be carried to both the stores ledger cards and to the corresponding controlling accounts.

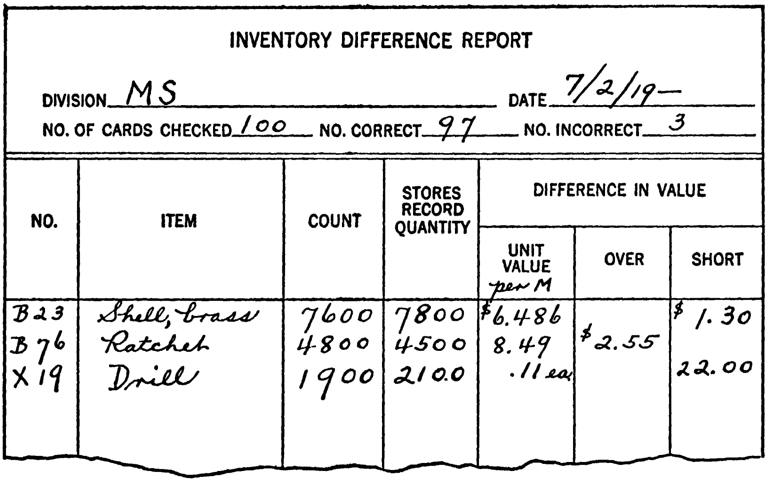
Inventory differences are summarized on an inventory difference report (Figure 45). This report serves as a journal voucher authorizing an entry to adjust the control account. In journal form the entry for a shortage would be:

Manufacturing Overhead (Inventory Over and Short)	$xx.xx	
Stores		$xx.xx

In case of an overage the above entry would be:

Stores	$xx.xx	
Manufacturing Overhead (Inventory Over and Short)		$xx.xx

The balance in Inventory Over and Short account is a manufacturing overhead item representing inventory differences resulting from natural shrinkage or change in condition, ordinary clerical errors in measuring, record keeping, and similar factors which are unavoidable in the practical operation of a business. By charging manufacturing overhead, the amount of the inventory shortage becomes part of the cost of manufacturing. However, inventory differences which are unusual in cause or size may be more properly closed to profit and loss if the difference is not connected with ordinary manufacturing operations. For example, a large shortage due to theft is a loss which should not increase the cost of goods manufactured during the period.



INVENTORY DIFFERENCE REPORT

DIVISION MS DATE 7/2/19—

NO. OF CARDS CHECKED 100 NO. CORRECT 97 NO. INCORRECT 3

NO.	ITEM	COUNT	STORES RECORD QUANTITY	DIFFERENCE IN VALUE		
				UNIT VALUE per M	OVER	SHORT
B23	Shell, brass	7600	7800	$6.486		$ 1.30
B76	Ratchet	4800	4500	8.49	$2.55	
X19	Drill	1900	2100	.11 ea.		22.00

Figure 45. Inventory Difference Report

In addition to posting the above summaries to the control accounts, it is also necessary to post each item to the individual stock ledger cards.

This is done by writing in the date and the words "Inventory Adjustment" on the next available line of the card. In case of a shortage the quantity is then posted in the "issued" column and the available balance as well as the balance on hand recomputed. In the case of an overage the "received" and balance columns are corrected.

Inventory Shortages and Monthly Reports. Where physical inventories are taken continuously throughout the year, the resulting inventory adjustments are currently reflected in the accounts and statements. Where, however, inventory is taken only once or twice a year, it may be desirable to reflect expected shortages or overages in the monthly statements. This can be accomplished by setting up an accrual entry at the end of each cost period:

Manufacturing Overhead (Inventory Over and Short)	$xx.xx	
Allowance for Inventory Adjustment		$xx.xx

This entry assumes that inventory shortages are, within limits, a regular expected cost of doing business. When the physical inventory is actually taken, the shortages then revealed are charged against Allowance for Inventory Adjustment account. Any balance in the latter, debit or credit, may at year-end closing be transferred to Profit and Loss. By this method only normally expected shortages are charged against cost of production. Any excessive shortages and overages appear as profit and loss charges and credits.

QUESTIONS

1. What governs the classification of material as direct or indirect?
2. Are boxes and containers direct materials? Explain.
3. Differentiate between a bill of materials and a stores requisition.
4. Differentiate between the terms "stores" and "raw material."
5. Why is it most important that an item code classification be used for stores?
6. If stores are recorded net of purchase discounts, how should discounts lost be accounted for?
7. The weighted-average method of pricing materials is merely an adaptation of the first-in first-out method. Explain.
8. Under what conditions would you suggest the adoption of a last-in first-out system of materials pricing? Explain how it operates and the important advantages of this approach.
9. Compare the effect of the three methods of pricing materials on the statement of profit and loss and the balance sheet under conditions of rising prices.

10. The last-in first-out system of pricing gives rise to a secret reserve in the balance sheet which can serve as a cushion for absorbing future losses. Explain.

11. The Waring Company is in the process of installing materials handling equipment in seven cold storage warehouses they own. Approximately 8% of their products kept in storage will hereafter be kept on wood pallets. In the cold storage warehouse industry the conditions to which pallets are subjected are different from other industries. Humidity and temperature conditions are exceptional. The storage periods average about three months so that wear and tear from actual usage is not very great.

    Comment upon:

    a) The accounting treatment of the original lot of pallets purchased
    b) The accounting for future purchases of pallets
    c) The handling of pallets if in the future they were to be made in the company's own shop

12. Your client is considering changing his method of inventory valuation from the first-in first-out (Fifo) method to the last-in first-out (Lifo) method. What will be your advice in respect of the following:

    a) If the change in methods is to be made as of January 1, what change is required in the valuation of the inventory at that date?
    b) If the Lifo method of inventory valuation is used during the year, what values attach to the quantities in the inventory on hand at December 31 which are in excess of the quantities in the inventory on hand at January 1?
    c) How may the December 31 inventory on hand be valued for purposes of financial statements if the market value at such date is lower than the Lifo cost?

13. It has been stated that cost for inventory purposes may be determined under any one of several assumptions as to the flow of cost (such as first-in first-out, average, and last-in first-out). The major objective in selecting a method should be to choose the one which, under the circumstances, most clearly reflects periodic income.

    a) For what reasons do accountants make assumptions as to the flow of cost instead of actually identifying the cost of the specific items which are sold?
    b) In any given case, on what would you base your decision as to which of the three assumptions of the flow of cost stated above most clearly reflects periodic income?

14. Explain what is meant by "continuous inventorying" and the advantages of this type of plan.

15. Physical inventories are often taken during a slack period and when quantities are at a minimum. As a result, the balance sheet values are not representative as setting forth the average financial position. Do you agree? Explain.

16. Cost or market whichever is lower is an inconsistent policy. Explain the inconsistency and the bases upon which this policy is justified.

17. List three possible sources for inventory shortages and three for inventory overages.

18. *a*) Inventory overages or shortages may be treated as they occur or they can be anticipated. Submit pro-forma journal entries under both methods.

    b) Explain the disposition of the balance in the account which measures the difference between the actual and estimated overage or shortage.

19. The Foster Corporation reports the following at December 31, 19—

	Cost	Market	Cost or Market Whichever Is Lower
Raw Materials	$60,000.00	$54,000.00	$52,500.00
Goods in Process	55,000.00	52,000 00	52,000.00
Finished Goods	80,000 00	73,000.00	70,000.00
Factory Supplies	6,000.00	7,000.00	6,000.00

a) Prepare the entry to adjust the inventory to lower of cost or market.

b) Explain how the effect of this entry would be reflected in the financial statements.

20. Refer to Question 19. Answer (*a*) and (*b*), assuming that the subsidiary records are to be maintained at cost.

21. Refer to Question 19. Prepare journal entry or entries if it is estimated that prices will decline in January of the following year 5% below December 31 prices.

22. Assume it were permissible for tax purposes to value inventories at Lifo cost or market whichever is lower. Would you suggest under these conditions that all firms use this method? Explain.

23. In the processing of steel by open hearth furnaces, the significant items placed into the furnace are hot metal, cold pig iron, and scrap. These materials are carefully weighed and accounted for. In addition, ore, ferro-alloys, and similar items are used in varying quantities from a few pounds to several hundred pounds per heat and are all charged into the furnace.

    Discuss method or methods of accounting for material consumption and their effect on inventory control procedure giving special attention to the reconciliation of the sum of daily material charges to the open hearth furnaces with the total amount of material charges based upon receipts and inventory records.

24. Which of the items below should be included in inventory:

    a) Materials received but for which no invoice has arrived

    b) Materials being transferred to another plant and in transit on inventory date

- *c*) Materials received in damaged condition and to be returned to vendor for credit
- *d*) Scrap to be sold
- *e*) Materials supplied by a customer under agreement whereby we are to process them
- *f*) Goods sent to dealers on consignment
- *g*) Merchandise sold but not yet shipped
- *h*) Materials not shown in stock ledger, but discovered by physical count
- *i*) Materials shipped and billed by vendor, but not received at inventory date

25. A company sells a patented device for use on railway locomotives. The device consists of several main assemblies which, in turn, comprise numerous subassemblies composed of many different parts. All materials entering into the device are purchased as finished parts, and the company's manufacturing operation is limited to their assembly. At the close of any day the inventory is in various stages of production, from purchased parts to finished devices.

The different parts, subassemblies, and main assemblies have fixed production numbers, and are carefully segregated in bins plainly identified by those numbers. A perpetual card inventory record, correspondingly numbered, is maintained in units and value. Production and sales are costed on the "last-in first-out" method. Several weeks before the balance sheet date you are requested by the company to suggest a plan for taking the inventory and arrange to make whatever verification you deem necessary in connection with your examination.

Briefly outline the following:

- *a*) Plan you would suggest to client; and
- *b*) Indicate pricing approach to inventory, assuming
  - (1) Quantities at end exceed quantities at beginning of year.
  - (2) Quantities at end of year are less than quantities at beginning of year.

Chapter 9

PAYROLL ACCOUNTING

Definition. Payroll accounting is that branch of the accounting or cost accounting department's work concerned with the determination of the periodic earnings of employees and their recording on the books of account. This involves the entire procedure connected with translating the employees' plant time or plant production into payroll dollars. It also includes procedures in connection with the many adjustments to an individual's pay made necessary under modern conditions.

Importance of Payroll Accounting. The importance of proper payroll procedure can be fully grasped only by a consideration of the various parties interested in the payroll. These include:

1. Federal and state governments in connection with:
   a) Deductions for old age benefits, unemployment insurance, and disability insurance
   b) Contributions by employers for social security purposes, workmen's compensation, and disability insurance policies
   c) Information returns covering earnings of employees
   d) Deduction at the source for federal income taxes, and in some states, for state income taxes
   e) Compliance with various statutes governing employer-employee relationships
2. Other external parties whose interest results from a growing tendency to make pay allotments for such things as union dues, savings bank deposits, bond purchases, health and welfare funds of unions; also insurance companies in connection with payroll audits under workmen's compensation policies.
3. Employees. Employees are interested of course in the size of their earnings and in what in recent years have come to be called "fringe" benefits. These assume many forms, such as vacation pay, "portal-to-portal" pay, and other time allowances for a variety of factors.
4. Management. In addition to paying workers and satisfying other external interests, the employer is interested in seeing what he receives for his payroll dollars. In short he is interested in tracing the payroll earnings to jobs or processes, that is, to the product.

This is commonly referred to as labor costing or labor distribution and is presented in the next chapter.

In addition the employer has an opportunity to improve labor-management relations, since the pay envelope or pay check forms a direct point of contact between employer and employees. This relationship may be strengthened by positive means, such as the establishment of insurance, thrift, pension plans, and other pay allotment plans supported in part by management; also by negative means such as the avoidance of dissatisfaction due to pay disputes resulting from carelessly and inaccurately prepared payrolls or the employment of unduly complex wage payment plans.

Organization of Payroll Functions. The great volume of work connected with payroll administration involves four distinct functions:

1. Employment and payroll changes. This includes hiring, discharging, and transferring of employees; also changes in rates of pay.
2. Timekeeping for payroll purposes, concerned with the accumulation of time data.
3. Preparation of the payroll.
4. Disbursing the payroll.

Supplementary functions include the determination of labor costs and the independent audit of all of the above through the office of the controller.

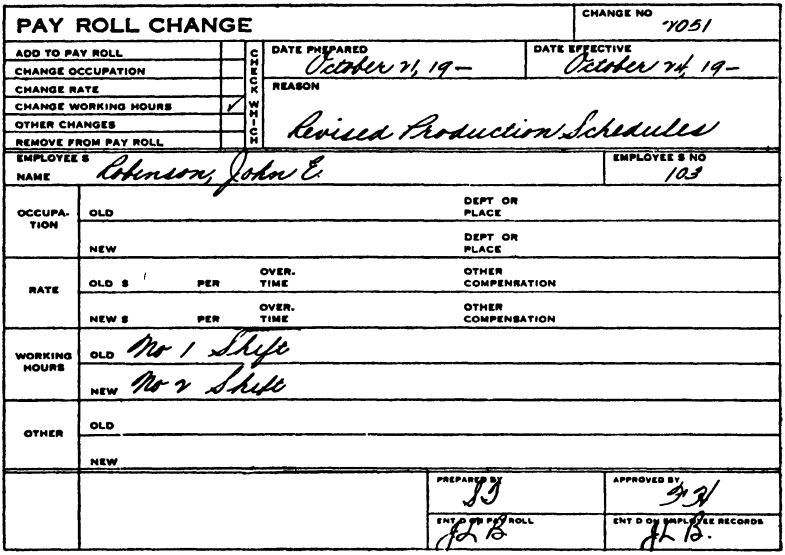
Employment and Payroll Changes

Change of Payroll Status. Every student of accounting has learned the importance of protective measures taken by business enterprises in safeguarding cash. Similarly earlier chapters in this book have attempted to show the procedures required to regulate the use or to guard against misuse of raw materials and other items of stores. Wherever cash or its equivalent must be disbursed, the need for safeguards is evident. The situation is no different in the case of payrolls. Not only is it necessary to guard against the ever-present possibility of clerical errors; there is also the problem of making certain that names on payroll registers are bona fide employees, that the same work is not paid for more than once, and that correct rates are used.

The prospective employee's first contact with a concern is through the personnel department. This department continues, throughout the employee's tenure, to exercise a general supervisory function over the employee in all matters pertaining to personnel relations in which payroll matters occupy a prominent position.

The payroll change recommendation (Figure 46) presents an orderly method for recording and obtaining approvals for employment of new employees and separation of old ones, and for all changes in their payroll status during their periods of service.

An individual payroll change recommendation is originated for each employee by a supervisor authorized to hire or discharge, or to initiate transfers or salary adjustments. He submits the forms to the personnel department, or to the official designated to approve payroll matters.



PAY ROLL CHANGE

CHANGE NO 2051

ADD TO PAY ROLL	☐	DATE PREPARED October 21, 19—	DATE EFFECTIVE October 24, 19—
CHANGE OCCUPATION	☐	REASON	
CHANGE RATE	☐	Revised Production Schedules	
CHANGE WORKING HOURS	☑		
OTHER CHANGES	☐		
REMOVE FROM PAY ROLL	☐		

CHECK WHICH

EMPLOYEE'S NAME Robenson, John E.

EMPLOYEE'S NO 103

OCCUPATION	OLD			DEPT OR PLACE
	NEW			DEPT OR PLACE
RATE	OLD $	PER	OVER-TIME	OTHER COMPENSATION
	NEW $	PER	OVER-TIME	OTHER COMPENSATION
WORKING HOURS	OLD No 1 Shift			
	NEW No 2 Shift			
OTHER	OLD			
	NEW			

PREPARED BY SJ

APPROVED BY FH

ENT'D ON PAY ROLL JLB

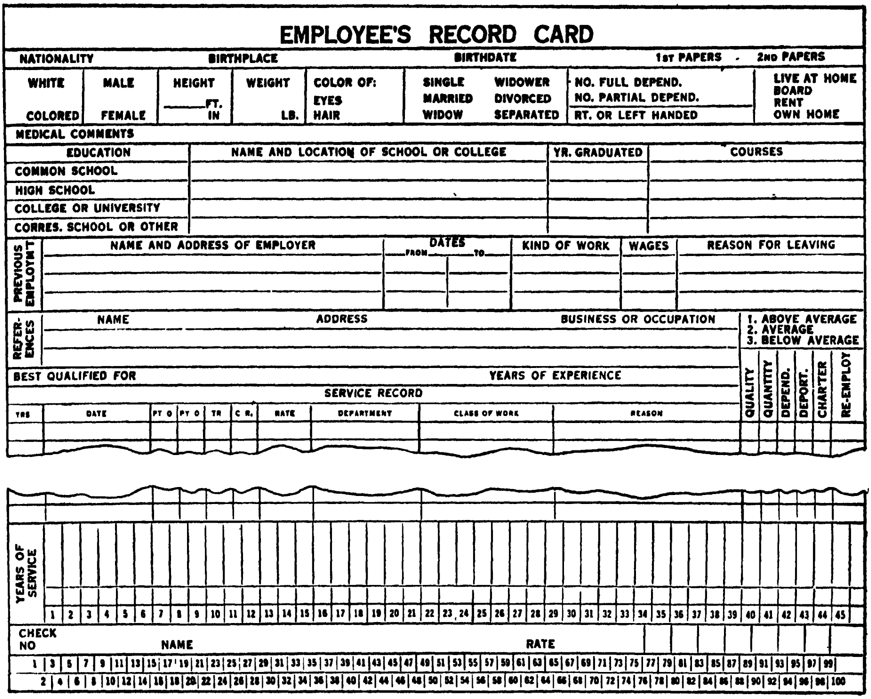
ENT'D ON EMPLOYEE RECORDS JLB.

FIGURE 46. Payroll Change Recommendation

Name Stencils. From the payroll change form the payroll department prepares addressing machine stencils. These are used for many different purposes, such as heading up clock cards, time tickets, badges and other identification, individual earnings records, payroll registers, pay checks or pay envelopes, social security reports, etc. The stencils are kept locked up or otherwise safeguarded, in order to keep rates of pay confidential, and to prevent unauthorized persons from preparing clock cards or other payroll documents which might be misused.

If there is a separate timekeeping department, not a part of the payroll department, a copy of the payroll change recommendation is sent to the timekeeper as the basis for establishing time records pending receipt of routine time cards from the addressing machine section.

New employees should be carefully advised as to when they will receive their first pay, where to get it, and what formalities or identification are necessary. They should also be told about any payroll deduction plans in effect, and should have an opportunity at once to sign any deduction authorizations which may be in order for new employees.



EMPLOYEE'S RECORD CARD

NATIONALITY BIRTHPLACE BIRTHDATE 1ST PAPERS - 2ND PAPERS

WHITE COLORED	MALE FEMALE	HEIGHT FT. IN	WEIGHT LB.	COLOR OF: EYES HAIR	SINGLE WIDOWER MARRIED DIVORCED WIDOW SEPARATED	NO. FULL DEPEND. NO. PARTIAL DEPEND. RT. OR LEFT HANDED	LIVE AT HOME BOARD RENT OWN HOME

MEDICAL COMMENTS

EDUCATION	NAME AND LOCATION OF SCHOOL OR COLLEGE	YR. GRADUATED	COURSES
COMMON SCHOOL			
HIGH SCHOOL			
COLLEGE OR UNIVERSITY			
CORRES. SCHOOL OR OTHER			

		DATES				
PREVIOUS EMPLOYM'T	NAME AND ADDRESS OF EMPLOYER	FROM	TO	KIND OF WORK	WAGES	REASON FOR LEAVING

REFER- ENCES	NAME	ADDRESS	BUSINESS OR OCCUPATION	1. ABOVE AVERAGE 2. AVERAGE 3. BELOW AVERAGE

BEST QUALIFIED FOR YEARS OF EXPERIENCE

SERVICE RECORD

YRS	DATE	PT O	PY O	TR	C R.	RATE	DEPARTMENT	CLASS OF WORK	REASON	QUALITY	QUANTITY	DEPEND.	DEPORT.	CHARTER	RE-EMPLOY

YEARS OF SERVICE

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45

CHECK NO NAME RATE

1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 33 35 37 39 41 43 45 47 49 51 53 55 57 59 61 63 65 67 69 71 73 75 77 79 81 83 85 87 89 91 93 95 97 99

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30 32 34 36 38 40 42 44 46 48 50 52 54 56 58 60 62 64 66 68 70 72 74 76 78 80 82 84 86 88 90 92 94 96 98 100

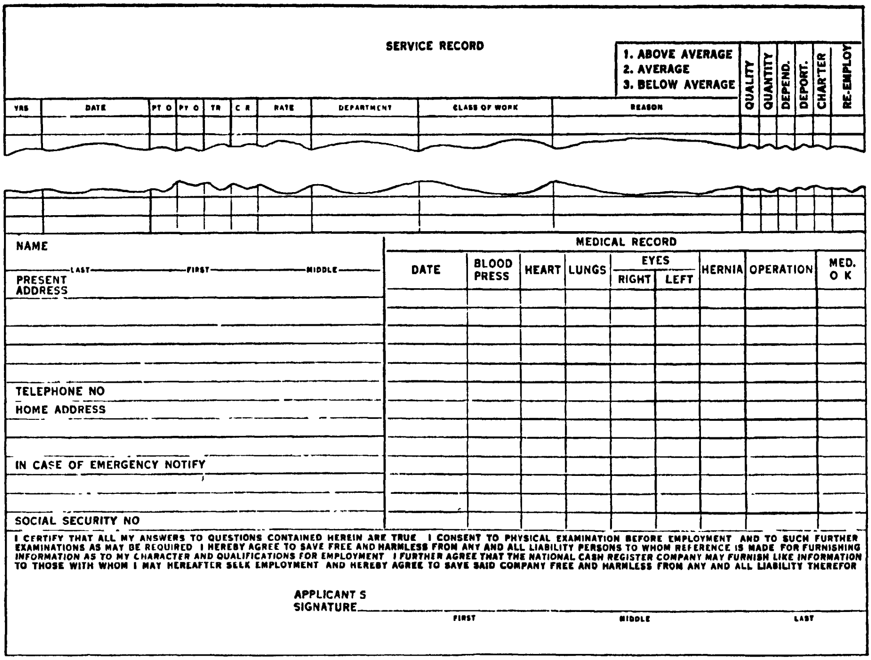
FIGURE 47*a*. Employee's Service Record (*face*)

Employee's Service Record. In most concerns it is desirable to maintain a permanent record of the service history of each employee. Figure 47 shows such a record giving complete information concerning the employee, both at the start of employment and throughout his association with the concern. Spaces may also be provided for the various deductions to be made. Entries in the lower portion of the form, and continuing to similar columns on the reverse side, are posted by the payroll department from subsequent payroll change recommendations or employment reports.

Timekeeping for Payroll Purposes

Registering Attendance. The fundamental purposes of any attendance record are:

1. To show the number of hours worked
2. To disclose absence or tardiness
3. To measure overtime for which extra pay may be due
4. To provide evidence of compliance with legal requirements



SERVICE RECORD

1. ABOVE AVERAGE
2. AVERAGE
3. BELOW AVERAGE

YRS	DATE	PT O	PT O	TR	C R	RATE	DEPARTMENT	CLASS OF WORK	REASON	QUALITY	QUANTITY	DEPEND.	DEPORT.	CHARTER	RE-EMPLOY

NAME
LAST FIRST MIDDLE
PRESENT ADDRESS
TELEPHONE NO
HOME ADDRESS
IN CASE OF EMERGENCY NOTIFY
SOCIAL SECURITY NO

MEDICAL RECORD

DATE	BLOOD PRESS	HEART	LUNGS	EYES		HERNIA	OPERATION	MED. O K
				RIGHT	LEFT			

I CERTIFY THAT ALL MY ANSWERS TO QUESTIONS CONTAINED HEREIN ARE TRUE I CONSENT TO PHYSICAL EXAMINATION BEFORE EMPLOYMENT AND TO SUCH FURTHER EXAMINATIONS AS MAY BE REQUIRED I HEREBY AGREE TO SAVE FREE AND HARMLESS FROM ANY AND ALL LIABILITY PERSONS TO WHOM REFERENCE IS MADE FOR FURNISHING INFORMATION AS TO MY CHARACTER AND QUALIFICATIONS FOR EMPLOYMENT I FURTHER AGREE THAT THE NATIONAL CASH REGISTER COMPANY MAY FURNISH LIKE INFORMATION TO THOSE WITH WHOM I MAY HEREAFTER SEEK EMPLOYMENT AND HEREBY AGREE TO SAVE SAID COMPANY FREE AND HARMLESS FROM ANY AND ALL LIABILITY THEREFOR

APPLICANT S SIGNATURE
FIRST MIDDLE LAST

FIGURE 47*b*. Employee's Service Record (*reverse*)

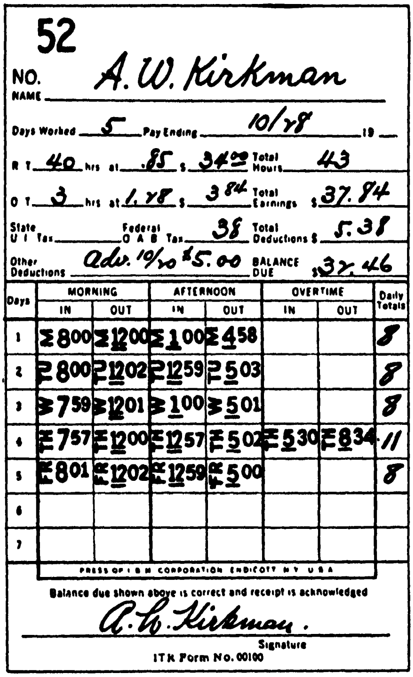
The means generally used to secure the above objectives are the clock card (Figure 48) and attendance register (Figure 49). Most time clocks comprise two basic features:

1. A clock-driven printing mechanism which stamps the exact time
2. An individual time card for each employee (Figure 49), upon which the times "In" and "Out" are stamped for each working period

Usually the in-and-out card provides spaces for an entire week, with a separate space for each morning, afternoon, or night period. The difference between the "In" time and the "Out" time indicates the time the worker has been in the plant each period.

It is common practice to provide two card racks, one for "Out" cards on one side of the clock, and one for "In" cards on the other side. These racks are under the eye of a watchman, who also examines badges or identification cards. In the "Out" rack are assembled all cards of employees who are out or not at work. As an employee enters the building he pulls his own card from the "Out" rack, stamps it as he passes the clock, and files it in the compartment bearing his clock number of the "In" rack. On the way out, the process is reversed. The watchman sees to it that only one card is handled by each employee, and that there is no back-tracking or repeating.

Attendance registers (Figure 49) may be used in place of clock cards or as an adjunct to them. In the latter case they are generally kept in the department where an employee works. He signs the register upon arrival and departure in the department, and also notes the time in or out. In addition there may be a floor check by the departmental timekeeper. The latter makes the rounds of the department several times a day and checks in all badge or payroll numbers.



52
NO. NAME A. W. Kirkman
Days Worked 5 Pay Ending 10/28 19
R T 40 hrs at .85 $ 34.00 Total Hours 43
O T 3 hrs at 1.28 $ 3.84 Total Earnings $ 37.84
State U I Tax ______ Federal O A B Tax 38 Total Deductions $ 5.38
Other Deductions Adv. 10/20 $5.00 BALANCE DUE $ 32.46

Days	MORNING IN	MORNING OUT	AFTERNOON IN	AFTERNOON OUT	OVERTIME IN	OVERTIME OUT	Daily Totals
1	M 8 00	M 12 00	M 1 00	M 4 58			8
2	TU 8 00	TU 12 02	TU 12 59	TU 5 03			8
3	W 7 59	W 12 01	W 1 00	W 5 01			8
4	TH 7 57	TH 12 00	TH 12 57	TH 5 02	TH 5 30	TH 8 34	11
5	FR 8 01	FR 12 02	FR 12 59	FR 5 00			8
6							
7							

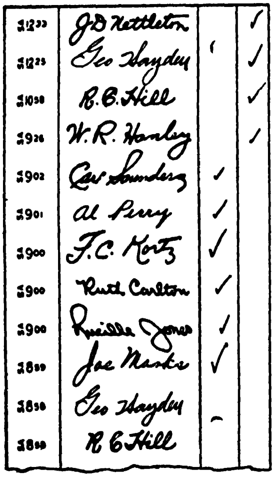
PRESS OF I B M CORPORATION ENDICOTT N Y U S A

Balance due shown above is correct and receipt is acknowledged

A. W. Kirkman.
Signature

ITK Form No. 00100

FIGURE 48. Combined Clock Card and Pay Receipt



SA 12 33	J D Nettleton		✓
SA 12 25	Geo Hayden	(	✓
SA 10 38	R. C. Hill		✓
SA 9 26	W. R. Hanley		✓
SA 9 02	Carl Saunders	✓	
SA 9 01	Al Perry	✓	
SA 9 00	F. C. Kortz	✓	
SA 9 00	Ruth Carlton	✓	
SA 9 00	Lucille Jones	✓	
SA 8 59	Joe Marks	✓	
SA 8 58	Geo Hayden	–	
SA 8 59	R C Hill		

FIGURE 49. Autographic Attendance Record

Irregular Arrival or Departure. In many plants, in-and-out time clock cards which have not yet been stamped "In" are collected from the racks when the shift begins, and employees who are late are required to go to the office to get them and be checked in. The timekeeper generally makes a "Late and Absence" report daily, with copies going to the employment manager, payroll department, and superintendent. The payroll department makes use of the information in case it is company practice to make deductions for lateness or absence.

In some companies it is the policy to grant certain absences with pay; e.g., for vacations, jury duty, or National Guard service. In such cases, approval of the proper officials should be noted on the time report or obtained by letter.

Preparation of Payrolls

Functions of Payroll Department. It is, of course, impossible to standardize the functions of a payroll department since they are bound to vary with local conditions. In some plants the payroll department is a special division of the cost accounting department, in others of the general accounting department, and in some it is an adjunct to the factory office. A fairly complete list might cover the following:

1. Determine regular and overtime hours.
2. Check and enter all wage rates.
3. Compute regular and overtime pay.
4. Compute additions to base pay. These include calculation and posting of bonuses, and making out, if necessary, bonus tickets. These calculations may be required daily, weekly, monthly, or at other intervals.
5. Prepare and compute the requisite payroll deductions and calculate and enter net pay.
6. Prepare all necessary documents in connection with the payroll:
    a) Payroll register
    b) Individual annual earnings record
    c) Pay check or pay envelope
    d) Statement of earnings and payroll deductions accompanying pay check or pay envelope

    In some cases, the payroll check register is also prepared by the payroll department.
7. Handle and prepare other records not part of the double-entry system but which are made necessary by law or other requirement; this includes reports and returns required by government agencies.
8. Prove all subsidiary records against control totals and check and balance out each original record, both as to dollar amounts and hours and sometimes quantities of production.
9. Deliver payroll checks to the proper persons for distribution to the workers on pay day. Where payment is made in cash, the audited payrolls are turned over to the paymaster for final processing.
10. Transfer necessary records and data to:
    a) Controller, general accounting department, paymaster
    b) Cost department

Regular and Overtime Hours. The determination of regular and overtime hours for each employee is a legal requirement under the Fair Labor Standards Act, commonly referred to as the Wage and Hour Law. This function has already been discussed under the heading "Timekeeping."

Check and Enter Wage Rates. Where a flat rate per payroll period is in force, such as a rate per week, the computation of the base pay offers no serious problem. Where the organization is large enough to warrant the use of addressing or tabulating equipment to prepare skeleton payrolls, the plates, stencils, or cards which are used to imprint the employees' names customarily show also the basic rate of pay for each individual. Corrections and changes in the rates recorded on the plates, stencils, or cards are made upon receipt of properly approved payroll change recommendations or employment reports.

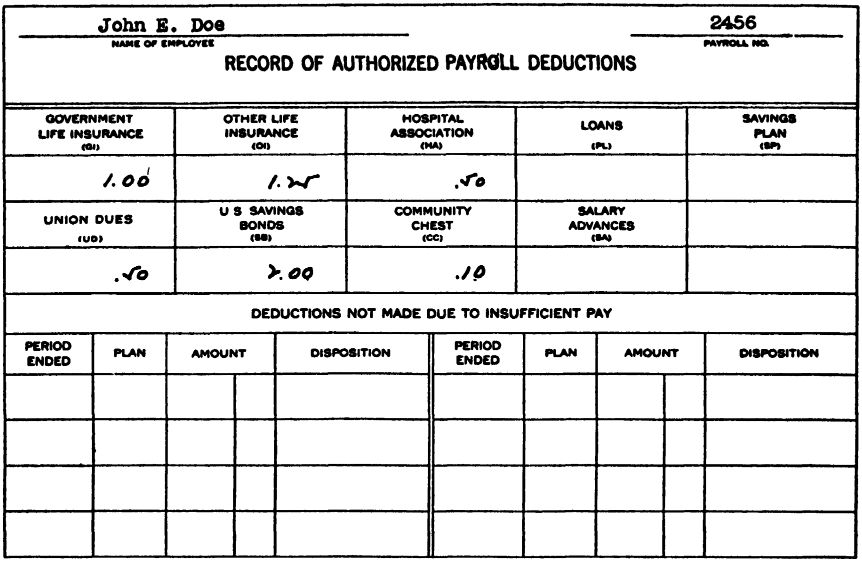
Where mechanical devices are not used, basic rates must be entered on skeleton payrolls and on time clock cards or periodical time and earnings records by hand or typewriter. The source of these entries is a record maintained especially for the purpose showing, for each job classification, the proper rate applicable. Where the entries are transcribed by hand or typewriter, it is doubly important to draw off a total of the entries and balance with the control total developed from the payroll change recommendation, so as to detect accidental errors as well as to guard against deliberate manipulation.

Computing Regular and Overtime Pay. Computation of the wages due each worker is the most voluminous and burdensome part of the entire payroll operation. Where the basis of remuneration is a monthly rate, a minimum of detail is required; more detail is necessary if the basis is weekly, still more on a daily or hourly basis. Where payments are made at piece rates, or under a group bonus system or other incentive plan, a maximum of detail is required.

Computation of actual pay from the basic rates should be made on the time clock card or time and earnings record in accordance with the time reported. Where flat rates of pay are used, this merely involves transcribing the rate to the "Regular Pay" column wherever full attendance is reported. Where hourly or piecework rates are in effect, or deductions for absence or tardiness are necessary, the calculations can best be made by means of mechanical computers or from prepared tables. Such tables can be purchased or constructed to cover not only straight salary but also bonus, differential, or piecework rates to suit the needs of a particular concern.

Compute Other Additions to Base Pay. Typical items constituting additions to base pay other than overtime are premium rates for night shifts, commissions, and bonuses, especially bonuses based on production accomplishments. Bonuses are usually figured weekly, though many plants compute them daily. They are intended generally as an incentive to greater production, and their value for this purpose is lost unless each workman is shown clearly the relation between his production and his bonus. It is good practice to insert a bonus slip in the pay envelope to show how the bonus was computed.

However, many plants prepare and distribute to the workers bonus tickets every day. This is in line with principles of scientific management that best results of an incentive scheme are obtained when rewards are immediate. A daily reminder is a stimulant to the worker to continue good work or to improve performance. Another advantage of daily bonus tickets lies in the fact that if errors occur they can be corrected before pay day. Corrections are easier because, in case of dispute, the facts are fresh in everyone's mind.



John E. Doe
NAME OF EMPLOYEE

2456
PAYROLL NO.

RECORD OF AUTHORIZED PAYROLL DEDUCTIONS

GOVERNMENT LIFE INSURANCE (GI)	OTHER LIFE INSURANCE (OI)	HOSPITAL ASSOCIATION (HA)	LOANS (PL)	SAVINGS PLAN (SP)
1.00	1.25	.50		
UNION DUES (UD)	U S SAVINGS BONDS (SB)	COMMUNITY CHEST (CC)	SALARY ADVANCES (SA)	
.50	2.00	.10		

DEDUCTIONS NOT MADE DUE TO INSUFFICIENT PAY

PERIOD ENDED	PLAN	AMOUNT		DISPOSITION	PERIOD ENDED	PLAN	AMOUNT		DISPOSITION

FIGURE 50. Authorized Deductions Card

Payroll Deductions. A distinction should be made between those deductions which are constant period after period, and those which are variable. Constant deductions are usually the result of a voluntary authorization made by the employee in accordance with the terms of a plan formally announced by the company. The announcement of the plan should describe clearly:

1. The purpose of the deductions
2. The method by which the employee authorizes deductions
3. Disposition of the funds by the company
4. The method by which the employee may withdraw

Deductions other than those required by law must be authorized by the employee. For convenience a summary of deductions (Figure 50) is prepared from these authorizations; it should be made out for each individual involved and used as the basis for recording deductions on the employee's earnings record and check stub. These forms should be filed in the same order in which the earnings records are filed.

Constant Deductions. Constant deductions do not vary in amount, although they may not occur every week. Some are made only monthly, and the weekly deductions may or may not be made when a fifth pay day occurs in a month. A schedule of such deductions is maintained and observed, spreading the deductions as evenly as possible, for example:

1st and 4th Payday

Commercial Insurance
Savings Bank
U. S. Savings Bonds

2nd Payday

Commercial Insurance
Savings Bank
U. S. Savings Bonds
Hospitalization

3rd Payday

Commercial Insurance
Savings Bank
U. S. Savings Bonds
Union Dues

5th Payday

Savings Bank
U. S. Savings Bonds

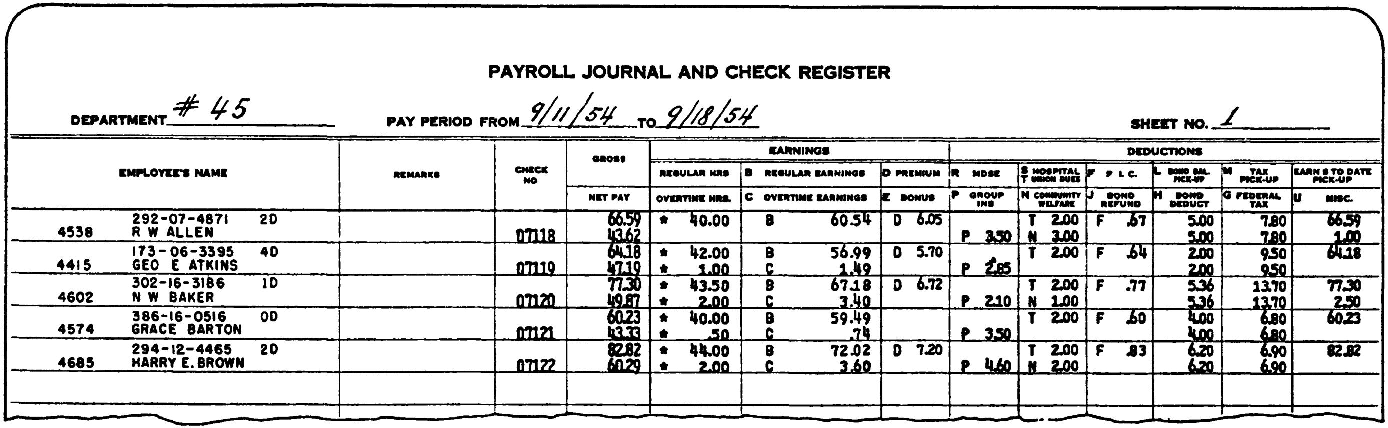
The schedule may be incorporated as part of the employee earnings record (Figure 54).

The instructions contained in the announcements of the various plans should clearly indicate which deductions are given priority in the event the pay is insufficient to warrant making all deductions.

Variable Deductions. Variable deductions from pay may vary in the following ways:

1. When there is no relation between the deduction and total pay, as in the case of absence or tardiness, penalty for spoilage, etc.
2. When deductions are calculated as a percentage of earnings
3. When the deductions involve either initial exemptions and later surtaxes as in the case of personal income taxes, or when they involve ultimate ceilings as in the case of old age benefit taxes

In contrast to constant deductions which can be entered on the payroll in advance of the end of the pay period, the variable deductions



PAYROLL JOURNAL AND CHECK REGISTER

DEPARTMENT # 45 PAY PERIOD FROM 9/11/54 TO 9/18/54 SHEET NO. 1

EMPLOYEE'S NAME		REMARKS	CHECK NO	GROSS	EARNINGS			DEDUCTIONS						
					REGULAR HRS	B REGULAR EARNINGS	D PREMIUM	R MDSE	S HOSPITAL T UNION DUES	F F. I. C.	L BOND BAL. PICK-UP	M TAX PICK-UP	EARN S TO DATE PICK-UP
				NET PAY	OVERTIME HRS.	C OVERTIME EARNINGS	E BONUS	P GROUP INS	N COMMUNITY WELFARE	J BOND REFUND	H BOND DEDUCT	G FEDERAL TAX	U MISC.
	292-07-4871 2D			66.59	★ 40.00	B 60.54	D 6.05		T 2.00	F .67	5.00	7.80	66.59
4538	R W ALLEN		07118	43.62				P 3.50	N 3.00		5.00	7.80	1.00
	173-06-3395 4D			64.18	★ 42.00	B 56.99	D 5.70		T 2.00	F .64	2.00	9.50	64.18
4415	GEO E ATKINS		07119	47.19	★ 1.00	C 1.49		P 2.85			2.00	9.50	
	302-16-3186 1D			77.30	★ 43.50	B 67.18	D 6.72		T 2.00	F .77	5.36	13.70	77.30
4602	N W BAKER		07120	49.87	★ 2.00	C 3.40		P 2.10	N 1.00		5.36	13.70	2.50
	386-16-0516 0D			60.23	★ 40.00	B 59.49			T 2.00	F .60	4.00	6.80	60.23
4574	GRACE BARTON		07121	43.33	★ .50	C .74		P 3.50			4.00	6.80	
	294-12-4465 2D			82.82	★ 44.00	B 72.02	D 7.20		T 2.00	F .83	6.20	6.90	82.82
4685	HARRY E. BROWN		07122	60.29	★ 2.00	C 3.60		P 4.60	N 2.00		6.20	6.90	

FIGURE 51. Payroll Register

must be computed after the close of the period. Thus deductions for absence or tardiness are made on the basis of late or absence reports mentioned earlier. Social security deductions are applied at the current rate of 1½% up to a ceiling limit of $3,600 of earnings for old age benefits and $3,000 for unemployment insurance. After the year's earnings have reached this point, no further deductions are made. Federal and, in some states, state income tax withholdings are made in accordance with instructions furnished by the tax collecting authorities.

Preparation of Payroll Documents. Three kinds of records are involved: the payroll, the pay check or pay envelope, depending on whether payments are made by check or in cash, including a statement of earnings for the employee's information; and finally, the individual earnings record. Wherever possible, these records are prepared simultaneously, that is, in a single writing. This is true in general of mechanical bookkeeping installations and even of some manual systems.

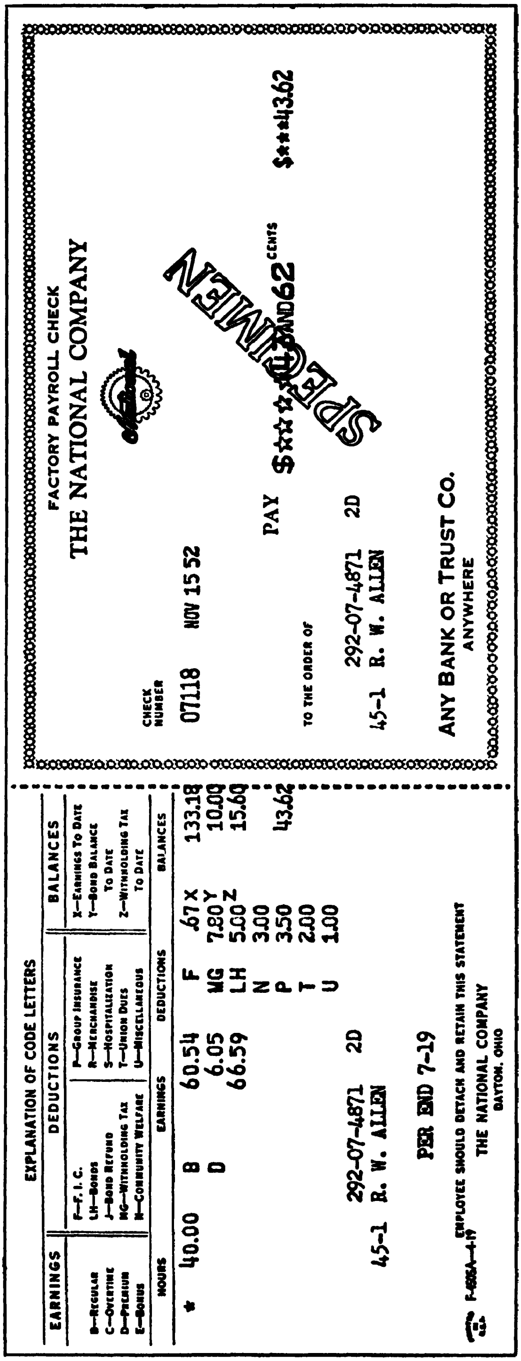
The *payroll or payroll register,* as it is commonly called, is usually prepared on a departmental basis and contains a variety of information (Figure 51), much of it required by law. The *payroll* is ordinarily designed in columnar form with a view toward using a summary of the column totals as support for the journal voucher showing charges to control accounts in the general ledger. The size and form of this record vary with the size and nature of the business, and with the kind of mechanical devices used in its preparation.

Pay checks are prepared on prenumbered stationery. The stationery stock is kept under lock and key in custody of a responsible official, and disbursed to the payroll clerk only as required. Accountability for every check number must be established. Spoiled checks are returned to the custodian of the blank checks, who voids them and keeps them in numerical order subject to audit. They should not be destroyed prior to audit.

Usually pay checks are provided with stubs, either at one end or along the top or bottom margin, on which the elements which make up the net pay are shown; e.g., base pay, overtime or bonus, and each of the deductions (Figure 52).

Pay envelopes should preferably be prepared by addressing machine. Usually the face of the envelope provides space for showing the elements which make up the net pay, and frequently the envelope flap is designed to be detached and used as the employee's acknowledgment of receipt (Figure 53).

The *individual annual earnings record* (Figure 54) is used both as a source medium for some postings and to receive a copy of other postings. The upper portion of the form is posted, at the time the employee is



EXPLANATION OF CODE LETTERS

EARNINGS	DEDUCTIONS		BALANCES
	F—F. I. C.	P—Group Insurance	X—Earnings To Date
B—Regular	LH—Bonds	R—Merchandise	Y—Bond Balance To Date
C—Overtime	J—Bond Refund	S—Hospitalization	
D—Premium	MG—Withholding Tax	T—Union Dues	Z—Withholding Tax To Date
E—Bonus	N—Community Welfare	U—Miscellaneous	

	HOURS		EARNINGS	DEDUCTIONS			BALANCES
*	40.00	B	60.54	F	.67	X	133.18
		D	6.05	MG	7.80	Y	10.00
			66.59	LH	5.00	Z	15.60
				N	3.00		
				P	3.50		43.62
				T	2.00		
				U	1.00		

292-07-4871 2D
45-1 R. W. ALLEN

PER END 7-19

F-4505A—4-19
EMPLOYEE SHOULD DETACH AND RETAIN THIS STATEMENT
THE NATIONAL COMPANY
DAYTON, OHIO

FACTORY PAYROLL CHECK
THE NATIONAL COMPANY

CHECK NUMBER 07118 NOV 15 52

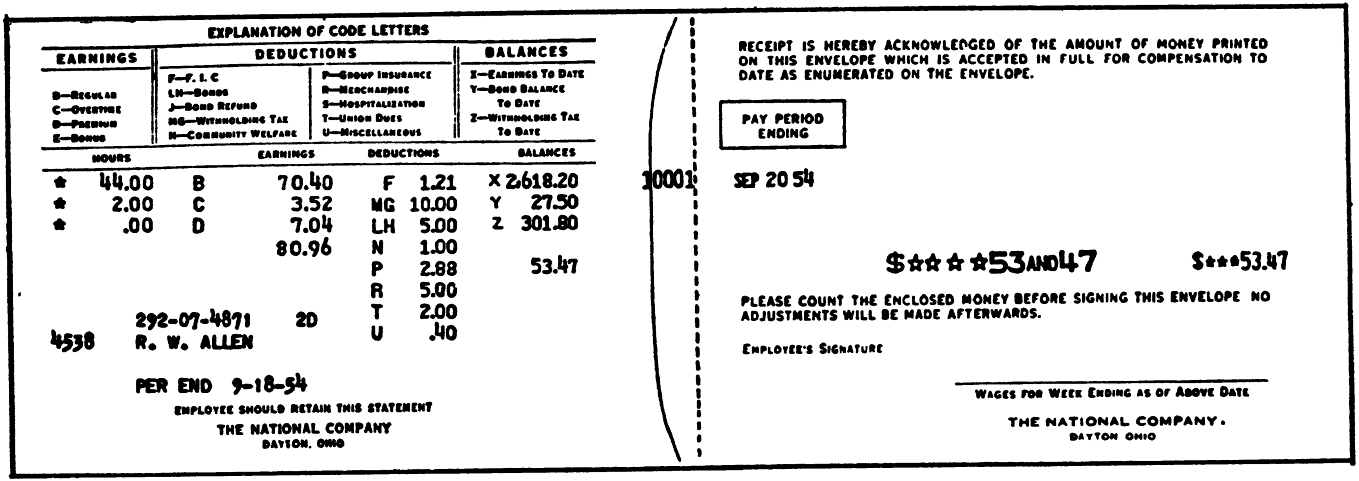
PAY $☆☆☆43AND62 CENTS $***43.62

SPECIMEN

TO THE ORDER OF
292-07-4871 2D
45-1 R. W. ALLEN

ANY BANK OR TRUST CO.
ANYWHERE

FIGURE 52. Pay Check



EXPLANATION OF CODE LETTERS

EARNINGS	DEDUCTIONS		BALANCES
B—Regular C—Overtime D—Premium E—Bonus	F—F. I. C LH—Bonds J—Bond Refund MG—Withholding Tax N—Community Welfare	P—Group Insurance R—Merchandise S—Hospitalization T—Union Dues U—Miscellaneous	X—Earnings To Date Y—Bond Balance To Date Z—Withholding Tax To Date

	HOURS		EARNINGS		DEDUCTIONS		BALANCES
★	44.00	B	70.40	F	1.21	X	2,618.20
★	2.00	C	3.52	MG	10.00	Y	27.50
★	.00	D	7.04	LH	5.00	Z	301.80
			80.96	N	1.00		
				P	2.88		53.47
				R	5.00		
				T	2.00		
				U	.40		

292-07-4871 2D

4538 R. W. ALLEN

PER END 9-18-54

EMPLOYEE SHOULD RETAIN THIS STATEMENT

THE NATIONAL COMPANY
DAYTON, OHIO

10001

RECEIPT IS HEREBY ACKNOWLEDGED OF THE AMOUNT OF MONEY PRINTED ON THIS ENVELOPE WHICH IS ACCEPTED IN FULL FOR COMPENSATION TO DATE AS ENUMERATED ON THE ENVELOPE.

PAY PERIOD ENDING

SEP 20 54

$★★★★53AND47 $★★★53.47

PLEASE COUNT THE ENCLOSED MONEY BEFORE SIGNING THIS ENVELOPE NO ADJUSTMENTS WILL BE MADE AFTERWARDS.

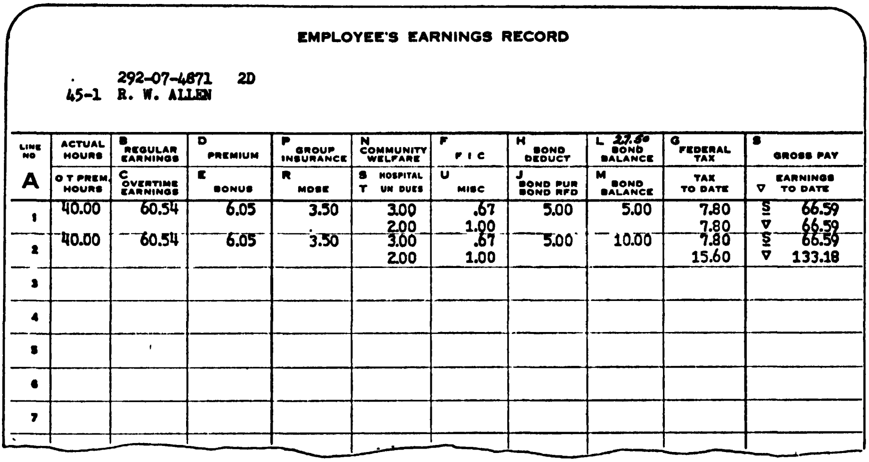
EMPLOYEE'S SIGNATURE

WAGES FOR WEEK ENDING AS OF ABOVE DATE

THE NATIONAL COMPANY.
DAYTON OHIO

FIGURE 53. Pay Envelope with Attached Receipt

hired, from the payroll change recommendation or employment report supplemented by the accompanying service record. Subsequent changes are posted from approved payroll change recommendations, deduction authorizations, and the payroll register.



EMPLOYEE'S EARNINGS RECORD

. 292-07-4871 2D
45-1 R. W. ALLEN

LINE NO	ACTUAL HOURS	B REGULAR EARNINGS	D PREMIUM	P GROUP INSURANCE	N COMMUNITY WELFARE	F F I C	H BOND DEDUCT	L 27.50 BOND BALANCE	G FEDERAL TAX	S GROSS PAY
A	O T PREM. HOURS	C OVERTIME EARNINGS	E BONUS	R MOSE	S HOSPITAL T UN DUES	U MISC	J BOND PUR BOND RFD	M BOND BALANCE	TAX TO DATE	∇ EARNINGS TO DATE
1	40.00	60.54	6.05	3.50	3.00 2.00	.67 1.00	5.00	5.00	7.80 7.80	S 66.59 ∇ 66.59
2	40.00	60.54	6.05	3.50	3.00 2.00	.67 1.00	5.00	10.00	7.80 15.60	S 66.59 ∇ 133.18
3										
4										
5										
6										
7										

FIGURE 54. Employee's Earnings Record

The earnings record (Figure 54) shows *cumulative total earnings* for the quarter and the year. When an employee enters or leaves the service, or when his record is transferred to another card, an appropriate cross-reference to other cards is made. A notation is added showing sufficient explanation of the circumstances, e.g., "resigned (date)," "transferred to (location or unit)."

Preparation of Other Records and Reports. There are several records which are not part of the double entry system but are made necessary by law or other requirements. These records include:

1. W-4 forms showing exemptions claimed by an employee in connection with federal income tax withholdings
2. Information returns (Forms 1099 and 1096) filed with the Treasury Department for payments to employees of amounts of $600 or more not subject to withholding tax
3. Annual withholding tax returns (Forms W2, W2a, and W3)
4. Quarterly combined social security reports covering federal old age benefits and withholding tax (Form 941) and state unemployment insurance compensation forms
5. Annual federal unemployment insurance reports (Form 940)
6. Reports to union for checkoff
7. All reports where employer is merely the fiscal agent

Proving Subsidiary Records. The payroll represents the most tangible point of contact with employees. Hence its accuracy is all important. The many records used in the payroll department make it necessary to check their respective figures against each other. The completed payroll registers, when totaled, form the basis of a journal voucher setting forth the payroll liability for earnings as well as for the various deductions. These figures must all be verified, not merely by going over the figures a second time, but by cross-checking against independently maintained records. For example, many companies maintain progressive control totals for base pay of employees. The base pay is carried forward from the last payroll; to it is added the base pay shown on all changes of pay status for newly hired employees; for employees discharged, their base pay is deducted from the control total. The balance represents the new control figure which the payroll department must achieve and which is used as the basis for predetermining base pay figures for the following payroll period in order to avoid all possible sources of errors.

A further check may often be had by comparing the payroll totals with the labor distributions made by the cost department. The two totals must obviously agree, since they represent different phases of the same thing. Each of the deduction totals must also be proved by recourse to original records or adding machine tapes.

Transfer of Records. The payroll department closes its work for the period by turning over to others copies of its payroll registers and other documents. Thus if it has prepared pay checks and earnings statements in connection with its work, it will transfer these to the paymaster for distribution to the employees. The pay registers are of course also furnished to the controller for audit and approval, to the general accounting department for vouchering, to the paymaster as a guide in distributing pay checks or pay envelopes, and to the cost department as a check against its labor distributions.

Payroll Disbursement

Payment in Cash. If payment is made in cash some means is required for safeguarding the funds from the time they leave the bank until they reach the employees. Some form must be provided on which to obtain the employee's acknowledgment of receipt of the pay. Distribution of the cash into pay envelopes involves considerable work, and if not done carefully, errors are bound to occur. The one advantage of this method is that it gives an opportunity to balance the whole cash operation before any cash is distributed.

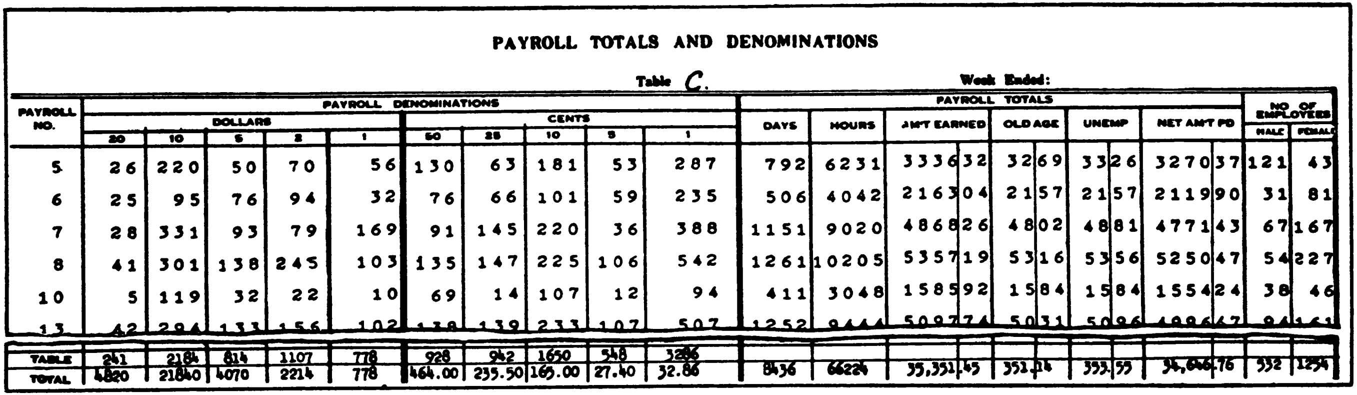
Denominating the Payroll. To fill pay envelopes efficiently, it is necessary to have on hand the proper quantities of currency and coin of the various denominations. This is accomplished by the process known as "denominating the payroll." The payroll sheet is provided with ten or more additional columns for the denominations from one cent to twenty dollars (Figure 55). Sometimes a separate form, ruled horizontally to match the payroll rulings, is used for this purpose. The denominations required to pay each item on the payroll are tallied, and the columns are totaled and balanced. A check for the total amount is drawn and presented to the bank with a list of the total quantities required of each denomination.

Filling Pay Envelopes. The job of placing proper amounts in each pay envelope is entirely completed to insure against overage or shortage before any envelopes are distributed. If the roll is large, each page may be totaled separately and a recapitulation prepared to obtain the grand totals. Then the paymaster can break down the total actual cash in accordance with the page totals preparatory to distributing the cash for each page into the corresponding pay envelopes. This makes it much easier to locate the error within a single page in case of overage or shortage.

Obtaining Receipts. When pay envelopes are delivered, the contents is checked by the employee, in the presence of the paymaster or other disbursing official. A receipt for the net amount is signed by the recipient and this is used by the paymaster to discharge his responsibility for the cash. Some concerns have a perforated receipt slip attached to the pay envelope for this purpose. Others, in order to save time at the pay window, distribute receipts to employees in advance through their foremen so that the employees may raise any questions and sign their receipts before they reach the pay window. This also serves as additional identification.

If payment is made by check, the indorsed check constitutes a receipt. Payment by check does not, however, entirely avoid the necessity for safeguarding funds. Some means must be provided for cashing the checks; this is good personnel practice and is mandatory under the laws of some states. If possible, arrangements are made with a nearby bank for cashing the checks.

Payroll Bank Accounts. Where payment is made by check and the payroll is large enough to justify it, a special payroll bank account is used. This special account, designated "Payroll Account," "Special," or other identifying term, is established and maintained by drawing checks on the regular company account and depositing them in the special account. In any case when the payroll has been completed, a



PAYROLL TOTALS AND DENOMINATIONS

Table C. Week Ended:

PAYROLL NO.	PAYROLL DENOMINATIONS										PAYROLL TOTALS						NO. OF EMPLOYEES	
	DOLLARS					CENTS					DAYS	HOURS	AM'T EARNED	OLD AGE	UNEMP	NET AM'T PD	MALE	FEMALE
	20	10	5	2	1	50	25	10	5	1								
5	26	220	50	70	56	130	63	181	53	287	792	6231	3336 32	32 69	33 26	3270 37	121	43
6	25	95	76	94	32	76	66	101	59	235	506	4042	2163 04	21 57	21 57	2119 90	31	81
7	28	331	93	79	169	91	145	220	36	388	1151	9020	4868 26	48 02	48 81	4771 43	67	167
8	41	301	138	245	103	135	147	225	106	542	1261	10205	5357 19	53 16	53 56	5250 47	54	227
10	5	119	32	22	10	69	14	107	12	94	411	3048	1585 92	15 84	15 84	1554 24	38	46
13	42	294	133	156	102	138	139	233	107	507	1252	9444	5097 74	50 31	50 96	4996 47	94	161
TABLE	241	2184	814	1107	778	928	942	1650	548	3286								
TOTAL	4820	21840	4070	2214	778	464.00	235.50	165.00	27.40	32.86	8436	66224	35,351.45	351.14	353.55	34,646.76	532	1254

FIGURE 55. Summary of Payroll Totals and Denominations

deposit is made for the exact amount of the payroll for which checks have been drawn so that after all checks have been issued, the account balances as shown by the check register.

Time and Place for Payment. The day and time of day for paying off depends on the individual setup, layout of the plant, number of employees, and various other details. The day of paying off should be as soon after the pay period closes as possible, allowing enough time to prepare the payroll without sacrificing accuracy. The time for paying off is so fixed that it does not interfere with the proper, efficient operation of the plant. A stagger method of payment is used by large organizations; that is, different departments are paid off on different days, at different times. This permits an even flow of payroll work, and makes possible the handling and paying of the payroll by a few employees, and payment by one or more paymasters, according to the number of employees.

As to the place of payment, if the number of employees permits, it is well to pay from pay booths or pay windows.

Identification of Employees. The simplest method of identifying employees is by employee's badge or check number. In small plants with few employees, this question does not come up. In this connection it is well to remember that most concerns prohibit assignment, that is, transferring of a right to wages by one worker to another.

Unclaimed Wages. If payment is not claimed at the regular time, the pay envelope is returned unopened to someone responsible for seeing that such envelopes are held in a safe place for a reasonable period until claimed by the employee. Sound internal check requires that these envelopes be held by someone who does not handle other company funds; this is usually the paymaster. When the employee eventually claims his pay, particular care should be taken to insure that he is properly identified in order to prevent some other worker under an assumed name from getting the pay envelope. After the lapse of a reasonable period, from 24 to 72 hours, envelopes still unclaimed are opened under suitable controls and the cash turned over to the general cashier to be merged with other company funds and deposited in the bank. Unclaimed Wages account is credited and a suitable subsidiary ledger record is set up. If the wages are later claimed, payment is made by voucher and charged to Unclaimed Wages.

If the unclaimed wages are in check form, the cashier indorses the check to himself as cashier, as follows:

Pay to the order of John Doe, Cashier
(Signed) John Doe.

Below this is written a cross-reference to the document which carries the original credit to Accounts Payable—Unclaimed Wages account. The cashier then deposits the check in his Payroll Cash account.

Sometimes unclaimed wages are turned over to a representative of the personnel department, who makes delivery a pretext for the initial call to check on the reason for absence. In such cases, signature on the signed receipt turned in by the personnel representative should be carefully compared with the signature on the employee's service record.

When all transactions are completed, as above, the net total of the payroll minus the credit to Unclaimed Wages is balanced with the file of signed receipts.

Auditing the Payroll. The bank statement for the Payroll Cash account is reconciled or audited regularly by the controller's department or some auditing staff other than the one which prepares the payroll records and checks. Duplicate bank deposit slips stamped by the bank, pages of the bank register, pages of the completed payrolls, and any voided checks are all forwarded promptly to the controller or auditor. The latter obtains bank statements and paid checks directly from the bank. Upon receipt of the bank statement, the total of the several deposits for each payroll period as shown on the bank statement is checked against the corresponding payroll totals after due allowance is made for deductions retained by the company. Canceled checks from the bank and voided checks from the payroll department are sorted together into one numerical sequence. Missing numbers are listed from information shown on the payroll, and this list of outstanding checks is used in reconciling the balance per bank statement with the balance per bank register (the latter normally being zero). Checks outstanding an undue length of time are followed up with a request that they be cashed.

Detailed spot audits of the Payroll Cash account are made by the staff of the internal auditing department from time to time. Among the points covered by the internal auditor are the following:

1. Compare the canceled checks with corresponding items on the individual annual earnings record with respect to name of payee and amount
2. Make an examination of indorsements by checking with original signatures on employee's service record
3. Determine that payments are made at authorized rates
4. See that all extensions, computations, and footings are correct
5. Insure that duplicate payments are not made
6. Check for proper approval of all allowances for absence
7. Determine that deductions are correct and made as required by law or as authorized by the employees

It is not intended to suggest that each payroll is audited in detail each week. At most test checks are made regularly with detailed audits of different departments at odd intervals.

QUESTIONS

1. List the deductions from payrolls required by law in your state assuming an employer has a staff of 20 full-time employees.
2. Assume an employer desired to set up a fund for payroll taxes withheld. Prepare entries assuming a gross payroll of $15,000; federal income tax withheld $2,800; old age insurance contributions $210; and disability insurance withheld $70.
3. What is meant by merit-rating as it relates to unemployment compensation insurance?
4. List seven state or federal regulatory or tax bodies which might on occasion audit the payrolls of a manufacturer.
5. Recognizing the many outside agencies concerned with payrolls, list the basic essential information that you would expect to find in a well-maintained system of payroll accounting.
6. Many states providing for merit-rating under the unemployment compensation laws have tax rates ranging from 0% to 2.7%. Accordingly, on a payroll of $1,000,000, a tax saving of $27,000 is possible. Indicate how adequate payroll accounting can contribute to minimizing unemployment compensation taxes.
7. Which of the following fringe benefits should be included in the base upon which payroll taxes are calculated: vacation pay, holiday pay, overtime, shift premiums, bonuses, pension contributions, premiums on employee insurance?
8. An employer of eight or more employees for a stipulated period during any year is taxable for both federal and state unemployment compensation taxes.
   a) Discuss the relationship between the federal and state unemployment compensation taxes.
   b) To what extent has the federal unemployment compensation law accomplished the purposes for which it was passed?
9. What are the functions of the payroll department?
10. The completion of the payroll registers marks the end of the payroll department's task. To whom are these records transferred and what purpose do they serve in each instance?
11. How is a change in payroll status (hiring, firing, raise, transfer, etc.) reflected in the payroll records?

Chapter 10

LABOR COSTS

Accounting for Labor Costs. Labor distribution accounting begins, roughly speaking, where payroll accounting leaves off. The purpose of the latter is to lay the basis for the payment of wages and salaries to the employees. By contrast labor distribution is strictly a cost function in that it assigns payroll costs to costs of production and distribution. The final step in payroll accounting is the creation of a charge to a Payroll account and a credit to a liability, Payroll Accrued, which is liquidated on payday. The aim of labor distribution is to break down the charge to Payroll, to show its component parts, and then to make the distribution entry to close out the payroll account.

Accounting for labor costs consists of identifying time spent in production with the product or, in the case of indirect labor, with departmental activity. By translating time into dollar equivalents, it is possible to determine the cost added to the product by the direct labor required to produce it, and to measure the effects of indirect labor on departmental costs. This process of analysis is also frequently referred to as "labor distribution." Its effect is to charge direct labor to the product through work in process and indirect labor to manufacturing overhead.

Objectives of Labor Costing. Labor costing is of primary interest to management which wants to know what it is getting for its labor dollar. By contrast, labor itself is concerned mainly with total earnings and, with some exceptions, gives little or no thought to questions of labor costs. From management's point of view the objectives of labor costing may be stated to be:

1. To identify direct labor with product costs
2. To use, where desired, direct labor as a basis for overhead application through an overhead rate based on labor cost or labor time
3. To use data on direct and indirect labor as a basis for control of efficiency of operations

The third objective involves a proper relationship between volume of production, quality of product, and compensation to the employee. Proper job classification and merit rating may help to secure labor best fitted to a given task. Control over quality and volume of production depends, however, upon many factors, some quite intangible. Among tangible factors may be cited efforts on the part of management, through scientific time and motion studies, to determine fair time allowances for each labor operation. When properly set, these time allowances become standards with which the actual time taken may be compared. Any difference represents relative efficiencies either better or worse than the standard. Thus the labor time data may be used as a means of measuring labor efficiency.

Direct Labor Defined. For cost accounting and control purposes it is necessary to differentiate between direct and indirect labor, often referred to as productive and nonproductive labor, respectively. The general rule is that direct labor is spent in actual production of the product, i.e., labor immediately identifiable with product costs. This means that to constitute direct labor it must be capable of being charged either to a job order or to a process depending on whether a job cost or process cost system is involved.

The amount at which the product charge is recorded represents the regular rates of pay either hourly or piece rates or other form of incentive pay. There is some question whether special premiums, bonuses, overtime payments, workmen's compensation insurance, and social security taxes on direct labor should themselves be considered part of direct labor cost. In practice some companies treat these items as supplementary direct labor charges, while others absorb them through manufacturing overhead.

Indirect Labor Defined. Indirect labor represents auxiliary work done in connection with product manufacture. It is labor not identifiable with the cost of a specific product, but which performs essential services. It includes all labor in service departments as well as auxiliary labor in producing departments. Examples of indirect labor include all workers in such departments as the storeroom, factory office, and building maintenance. It also includes certain workers in producing departments, such as departmental foremen, timekeepers, clerical assistants, and mechanics.

Difficulty of Segregation. It is evident that the distinction between direct and indirect labor may sometimes be difficult to establish. Where fully automatic machinery is used, the worker becomes in effect a machine tender. The machine alters the size or shape of the product while the worker merely feeds the machine at intervals and makes minor adjustments. For example, the question might be raised whether a worker at a modern loom in a textile plant is a weaver (direct labor), a machine adjuster (direct labor), or a repair man (indirect labor).

Modern production technique has forced a reconsideration of what constitutes direct labor. It is clear that if a man is tending a productive machine his labor is as direct as the labor of one producing goods manually. Frequently trade terminology may influence the classification. In the above example the worker may be a weaver or a machine tender according to trade terminology, and in both cases be direct labor, but if he is a repair man or setup man, he may be classified as indirect labor.

Timekeeping as Basis for Labor Costing. For cost purposes a job record or work report is used as the basis for the distribution of the payroll. The prime functions of this phase of timekeeping are:

1. To know the quantity of work done on each job
2. To know the cost of the work done

The time of workers in a shop may be kept by themselves, by their foremen, by a traveling timekeeper, or by a stationary timekeeper. No universal rule can be laid down as to who should keep time since individual circumstances govern the problem.

Duties of Timekeeper. In general, a timekeeper's responsibility covers four types of activity:

1. Handling of time cards in the shop
2. Preparation of time tickets for the payroll or cost department
3. Production reporting
4. Production planning

The timekeeper's duties include among other duties the preparation of daily time tickets, checking the correctness of each item on the time ticket except the rate and earnings, turning over each day's time tickets to the payroll department the following morning, maintenance of a cumulative record of quantities produced by operations, and obtaining the foreman's approval on job tickets. In addition, he may be required to maintain certain departmental stock records, report daily production and absenteeism, and assist in inventory taking.

Types and Forms of Time Tickets. The source of all labor classification entries is a work record, usually a time ticket specifying for a given operation the number of hours spent on production or pieces or both. Essentially a time ticket is an authorization to the worker to perform a given operation and at the same time a means of accumulating data as to earnings or labor costs or both.

For the purpose of labor cost accumulation and production control, many forms of time tickets are used. In continuous process production, it is possible to combine the payroll record with the time ticket, since the worker in all likelihood is doing the same work continuously. In general, however, the following conditions may prevail, covering the issuance of time tickets:

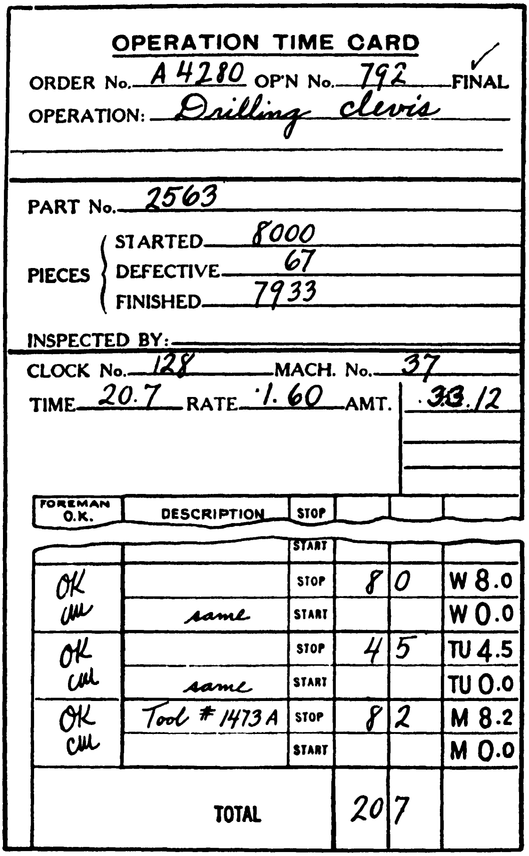
1. A single ticket issued covering an entire payroll period. Sometimes, one ticket may be issued for an entire job, with the proviso that if the job is not finished by the end of the payroll period, the ticket must be turned in at that time and a new one obtained.
2. A new ticket issued each day. If more than one job is worked on in the course of a day, the distribution of the time to each job is indicated on that ticket.
3. Separate tickets for each job worked on each day (unit tickets).
4. Time sheets used as a basis for producing punched tabulating cards.
5. Group or gang sheets to keep time for a group of workers.

SINGLE TICKET FOR A PAYROLL PERIOD. The use of a single ticket for an entire payroll period is advisable only in those cases where a worker is doing the same work regularly. It is, therefore, not advisable in the case of job order industries. Where this system is used, however, a separate payroll procedure must be developed, since payroll and labor cost procedures are independent functions.

A variation of the above scheme consists of issuing a separate ticket for each order. The operator keeps the ticket until the order is completed. Figure 56 shows completion of the work on Wednesday. Hence the word "Final" is checked. All tickets must be turned in whether the job is completed or not at the end of the payroll period, so that the resulting labor costs may be checked against the payroll records.

SINGLE TICKET FOR EACH DAY. Where a single ticket is used to show labor distribution in the course of a day, it is so designed that it shows the operation or order number, the start and ending time, the elapsed time, and, in some cases, the rate, and the labor cost (Figure 57). The advantage of this system is that the clock record is on the same form as the labor distribution, making comparison and reconciliation easier. However, any instructions concerning the work to be done must be shown on a separate form.

UNIT TICKETS. Figure 58 shows a form of time ticket representing a high degree of flexibility. A separate ticket sometimes called a *unit ticket* is issued for each job each day. Thus a worker turns in during the day as many tickets as there were jobs worked on. The ticket in question contains all information necessary for payroll as well as labor cost calculations. Much of the information is preprinted. The employee's number and name are imprinted from an Addressograph stencil. The time issued and returned is stamped by an electric clock. The bottom portion as to quantity and hours is filled in by the timekeeper, rates and extensions by the payroll department.



OPERATION TIME CARD ✓

ORDER No. A 4280 OP'N No. 792 FINAL

OPERATION: Drilling clevis

PART No. 2563

PIECES STARTED 8000

PIECES DEFECTIVE 67

PIECES FINISHED 7933

INSPECTED BY:

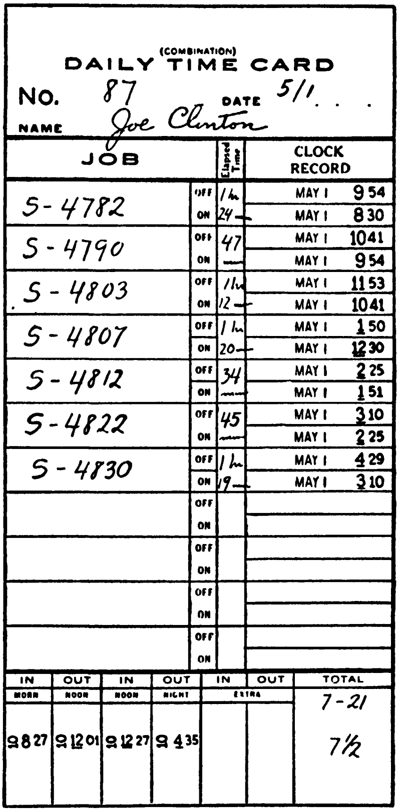
CLOCK No. 128 MACH. No. 37

TIME 20.7 RATE 1.60 AMT. 33.12

FOREMAN O.K.	DESCRIPTION	STOP			
		START			
OK		STOP	8	0	W 8.0
cm	same	START			W 0.0
OK		STOP	4	5	TU 4.5
cm	same	START			TU 0.0
OK	Tool # 1473 A	STOP	8	2	M 8.2
cm		START			M 0.0
	TOTAL		20	7	

Figure 56. Job Order Time Ticket

Checking Time Cards. At the end of a shift when the clock cards have been rung out by employees, they are forwarded to the payroll department. If payment is made strictly on the basis of time worked, the timekeeper's detailed time tickets for operations performed by each individual employee are reconciled each day with the in-and-out clock card, or other attendance record. Any difference in time is investigated at once and charged to some such departmental expense account as "Lost Time," if it is found not to be chargeable to production. Thus total productive hours plus lost time reported for cost accounting purposes balance with total hours reported for payroll purposes. At the time of this reconciliation, the hourly rate may be posted to the time tickets preparatory to computing job labor costs.



(COMBINATION)
DAILY TIME CARD

NO. 87 DATE 5/1 . . .

NAME Joe Clinton

JOB		Elapsed Time	CLOCK RECORD
S-4782	OFF	1 h	MAY 1 9 54
	ON	24	MAY 1 8 30
S-4790	OFF	47	MAY 1 10 41
	ON		MAY 1 9 54
S-4803	OFF	1 h	MAY 1 11 53
	ON	12	MAY 1 10 41
S-4807	OFF	1 h	MAY 1 1 50
	ON	20	MAY 1 12 30
S-4812	OFF	34	MAY 1 2 25
	ON		MAY 1 1 51
S-4822	OFF	45	MAY 1 3 10
	ON		MAY 1 2 25
S-4830	OFF	1 h	MAY 1 4 29
	ON	19	MAY 1 3 10
	OFF		
	ON		
	OFF		
	ON		
	OFF		
	ON		
	OFF		
	ON		

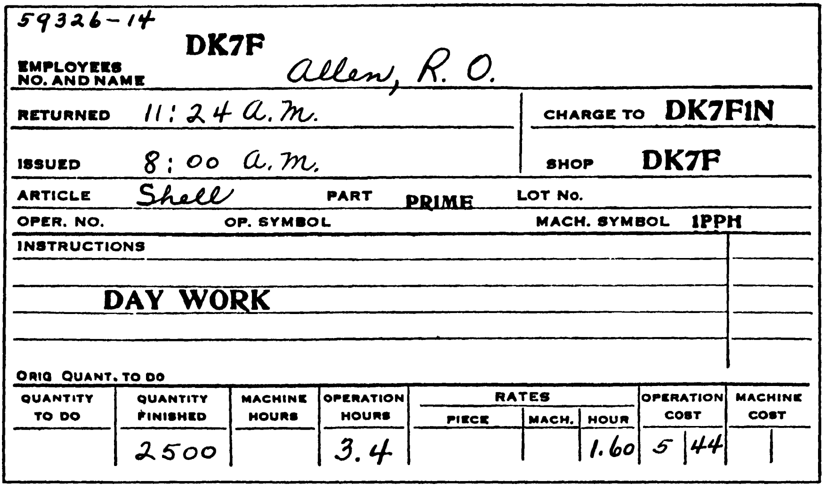
IN	OUT	IN	OUT	IN	OUT	TOTAL
MORN	NOON	NOON	NIGHT	EXTRA		7-21
10 8 27	10 12 01	10 12 27	10 4 35			7½

Figure 57. Combined Clock-Card and Job Time Ticket

If payment is made on a piecework or bonus basis, the timekeeper's detailed tickets constitute a basis for calculating pay. The pertinent data should be either posted each day to the in-and-out clock card, or other attendance record, or at least checked against it.

When the actual hours on the daily time cards are checked by the payroll department against the time clock markings on these cards, the propriety of job charges on the cards is reviewed.

Disposition of Time Tickets. The time or piecework tickets, after reconciliation with payroll data, are turned over to the cost department. All such tickets are posted to their proper shop orders through some form of columnar distribution sheet or by means of some other suitable distribution medium, in order to determine the exact labor costs on each individual work order.



59326-14

DK7F

EMPLOYEES NO. AND NAME Allen, R. O.

RETURNED 11:24 a.m.

CHARGE TO DK7F1N

ISSUED 8:00 a.m.

SHOP DK7F

ARTICLE Shell PART PRIME LOT No.

OPER. NO. OP. SYMBOL MACH. SYMBOL 1PPH

INSTRUCTIONS

DAY WORK

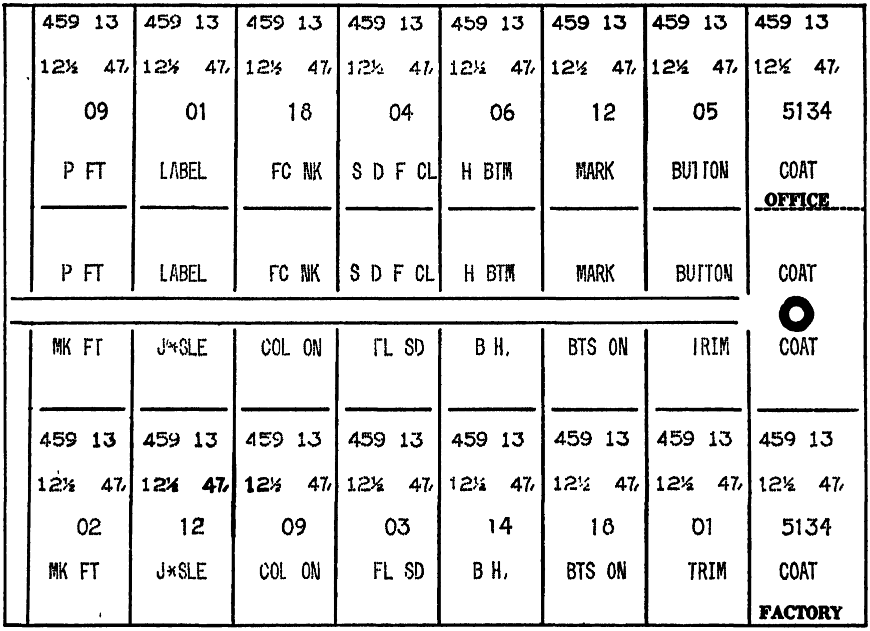
ORIG QUANT. TO DO

QUANTITY TO DO	QUANTITY FINISHED	MACHINE HOURS	OPERATION HOURS	RATES			OPERATION COST	MACHINE COST
				PIECE	MACH.	HOUR		
	2500		3.4			1.60	5 44	

FIGURE 58. Unit Labor Cost Ticket

Preprinted Time Tickets. Some concerns, upon receipt of bills of materials or blueprints, have a time setter prepare a time card for each operation or each job. He shows the time allowed for the operation and the machine or group of machines on which the operation is to be done. The time card then serves both as a work assignment and as a record of time actually spent on the job, as compared with the time originally estimated. This method is used particularly where premiums are paid for beating the standard.

Another arrangement is handled by the production department. With each manufacturing order the production department sends the factory an envelope containing all necessary piecework labor tickets to complete the order. These tickets show details of operations, quantity to make, and piecework rate. The only information left to be put on the tickets in the factory is the operator's number and elapsed time, and possibly particulars as to materials used. Figure 59 is an example of such a ticket prepared on a ticketograph. Usually these tickets are produced with the aid of a complete master set of addressing plates or stencils, one plate or stencil for each direct labor operation and a set of plates for every regular stock item. When an item is to be put into production, the production department selects the set of plates for that item, prefixes an auxiliary plate showing the quantity to be manufactured and the order number, and prints the labor tickets from them. By this method all direct labor operations are controlled, as no operation can be performed without one of these printed time tickets, no pencil-written time tickets being honored by the payroll department.



459 13	459 13	459 13	459 13	459 13	459 13	459 13	459 13
12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/
09	01	18	04	06	12	05	5134
P FT	LABEL	FC NK	S D F CL	H BTM	MARK	BUTTON	COAT OFFICE
P FT	LABEL	FC NK	S D F CL	H BTM	MARK	BUTTON	COAT
MK FT	J*SLE	COL ON	FL SD	B H.	BTS ON	TRIM	COAT
459 13	459 13	459 13	459 13	459 13	459 13	459 13	459 13
12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/	12½ 47/
02	12	09	03	14	18	01	5134
MK FT	J*SLE	COL ON	FL SD	B H,	BTS ON	TRIM	COAT FACTORY

FIGURE 59. Preprinted Direct Labor Ticket

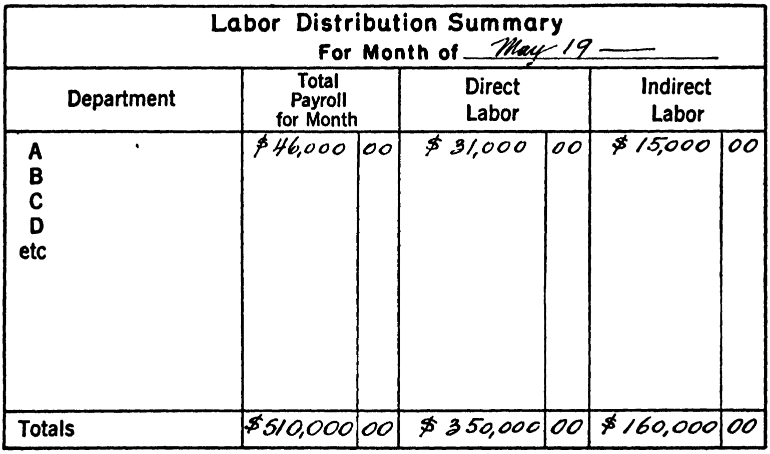
Pricing Elapsed Time. Time may be extended on the basis of actual pay rates of individual employees, or at average rates for closely associated groups of employees. If individual rates are used, these rates must be transcribed to the job tickets from master rate cards showing the current authorized rates. Extensions may then be made through the use of prepared tables, tabulating equipment, or calculating machines.

Steps in Accounting for Labor. The procedure in accounting for payrolls and labor distributions is basically the same whether manual or mechanical methods are employed. The following represent the functions that must be performed to accomplish the accounting objectives:

1. The daily or weekly time tickets are segregated for direct labor and indirect labor. This sorting is also done for each department or cost center. Totals are entered daily on a departmental payroll analysis. The analysis may of course be made weekly or even monthly.

2. Totals of time tickets are checked against totals on the payroll register sheets.
3. The time tickets for direct labor are further sorted by jobs, classes of products, operations, or processes; totals for each subclassification are computed and posted to job cost sheets or process accounts.
4. The time tickets for indirect labor are sorted by departments or cost centers, and within each cost center by classes of indirect labor established for the plant.
5. Postings for indirect labor are made on a weekly or monthly basis. If weekly overhead reports are required, the posting is done weekly. This is preferable to monthly posting if overhead is to be promptly and adequately controlled.
6. Totals of direct labor charged to production and of indirect labor charged to overhead are checked against total earnings for the same period shown by the payroll register sheets.

A simple form of departmental payroll analysis is shown in Figure 60. Its purpose is to summarize, day by day, the amount of direct and indirect labor. At the end of the month the departmental totals are brought together in a single labor distribution summary (Figure 61), which then serves as a basis for a journal voucher summarizing the labor distributions:



Labor Distribution Summary

For Month of May 19—

Department	Total Payroll for Month		Direct Labor		Indirect Labor	
A	$46,000	00	$31,000	00	$15,000	00
B						
C						
D						
etc						
Totals	$510,000	00	$350,000	00	$160,000	00

FIGURE 60. Monthly Departmental Labor Record

(1)

Work in Process	$xx.xx	
Manufacturing Overhead	xx.xx	
Payroll Accrued		$xx.xx

To distribute direct and indirect labor for the month.

MONTHLY DEPARTMENTAL LABOR ANALYSIS

For Month of May 19— Department A

Date	Labor Hours	Daily Payroll		Direct Labor		Indirect Labor	
1	1600	$2400	00	$1700	00	$700	00
2							
3							
4							
5							
6							
7							
30							
31							
Totals	32,000	$46,000	00	$31,000	00	$15,000	00

FIGURE 61. Summary or Recapitulation Labor Sheet

Whenever a payroll period ends and the audited payroll is approved, a voucher is prepared which, when recorded in the voucher register, produces the following entry:

(2)

Payroll Accrued	$xx.xx	
Vouchers Payable		$xx.xx
Social Security Taxes Payable		xx.xx

To record workers' earnings for week ending ——.

The liquidation of the payroll results in an entry in the check register as follows:

(3)

Vouchers Payable	$xx.xx	
Cash		$xx.xx

To record disbursement of payroll for week ending ——.

The above three entries comprise the entire cycle of operations for payroll accounting and labor distributions in highly simplified form. Many variations are possible. For example, entry (1) above may be varied by introducing departmental work in process accounts or subdividing work in process according to cost elements. More often, however, the method is varied because the payroll entry and the distribution entry are prepared by different departments. In such cases a clearing account, Payroll or Payroll Clearing, becomes necessary:

(1)

Payroll	$xx.xx	
Payroll Accrued		$xx.xx

To summarize payroll register for the week.

(2)

Work in Process	$xx.xx	
Manufacturing Overhead	xx.xx	
Payroll		$xx.xx
To distribute labor costs.		

In this way the debit to Payroll is offset by a credit in the distribution entry. Whichever method is used it is to be understood that the debit to Work in Process is supported, as explained above, by postings to individual job cost sheets or process accounts. The debit to Manufacturing Overhead is similarly supported by debits to individual overhead accounts and also to departmental expense accounts.

The following illustration reveals a more complex situation. A voucher is used with parallel columns for the weekly payrolls and a grand total column. The monthly summary entry to record the payroll liability might then appear as follows:

Payroll	$110,000.00	
Reserve for Vacation Allowances	8,000.00	
Federal Old Age Benefits Tax Payable		$ 1,050.00
Withholding Tax Payable		5,000.00
Accounts Receivable—Employees		
Group Insurance		92.00
Loans		20.00
Tool Kits		42.00
Uniforms		15.00
Accounts Payable—Sundry		
Badge and Locker Deposits		7.00
Employees' Saving Bonds		260.00
Garnishees		29.00
Hospitalization		11.00
Vouchers Payable (or Payroll Accrued)		111,474.00
To summarize general and factory payrolls.		

The above entry shows that the total earnings of employees for the month amounted to $110,000, exclusive of vacation pay of $8,000. However, after various deductions, there remained a net amount of $111,474 to be disbursed to employees. The first deduction is for federal old age benefits and represents the amount deducted from employees earnings at the rate of 1½% of gross earnings up to a maximum of $3,600 earned in any one year. Since 1½% of $110,000 is $1,650 it is evident that some employees are no longer subject to deductions in the current year. The amount so withheld is a liability and is payable to the federal government.

The withholding tax deduction for federal income taxes is made in accordance with statutory requirements and information furnished by the employee concerning exemptions claimed. The amounts withheld are liabilities and are liquidated in the following month by remittances to an approved depository.

The credit to the account Accounts Receivable—Employees is made up of a number of subcredits. The entire group represents advances made by the company on the employees' behalf for which it reimburses itself on pay day. In this instance the company has paid group insurance premiums, has loaned money to employees, furnished tool kits and uniforms. For all these items it has previously charged the above account which is being liquidated in whole or in part through these payroll deductions.

Accounts Payable—Sundry, representing a miscellany of liabilities of the employer other than trade creditors, is also subdivided to show the particular deduction made. Badge and locker deposits will have to be refunded to the employee upon termination of his employment. The other credits represent amounts deducted which must be turned over by the employer to third parties in accordance either with statutory requirements or voluntary agreements between employer, employee, and some other agency. Thus the employer at the proper time must purchase government savings bonds and turn them over to the employee. He must turn over to the proper authorities the amounts deducted under garnishee proceedings; and he must turn over to the Blue Cross or other designated agency the amounts deducted for hospitalization and other medical benefits. The net credit resulting, after taking account of the deductions, is made to Vouchers Payable or Payroll Accrued.

Vacation Allowance. The treatment of vacation pay, illustrated above, is in keeping with the prevailing practice of extending vacation pay benefits to production workers as well as administrative employees. When vacation pay or allowances were restricted to the latter group of employees, they were normally recorded as expense when paid. Because of the general practice of covering all employees under arrangements for vacation pay, a monthly accrual is necessary. Certainly, with regard to factory workers, this is a substantial cost and should be recorded when incurred. The employee earns the right to vacation pay allowance throughout the year and cost accountants generally consider the cost as representing manufacturing overhead which should be incorporated in computing the cost of production.

Thus, each month or each pay period, in connection with costing labor, there is included a debit to Manufacturing Overhead—Vacation Allowances in the amount of the portion of estimated annual vacation pay attributable to this period's operations. The credit is to the Reserve for Vacation Allowances.

When the voucher is prepared for the payment of the payroll, the gross value (before payroll taxes) of any vacation pay to be disbursed is debited to the Reserve for Vacation Allowances.

Employer's Payroll Taxes. In addition to acting as a collector of taxes for the federal government, and in some jurisdictions, for the state and local governments as well, the employer is liable for federal social security taxes. These include old age benefit taxes at the rate of 1½% of wages paid to a maximum $3,600 per year employee and federal unemployment insurance tax of 3% of wages paid to a maximum of $3,000 per year per employee with a maximum credit of 90% of the latter tax for contributions made under state unemployment compensation tax laws. Employers are also liable for state unemployment compensation taxes levied under a range of rates with a maximum of 3% and under varying conditions of qualification and merit-rating credits varying according to the separate laws of the forty-eight states.

These payroll taxes are incurred as an incident to employing labor. Logically, the payroll taxes on direct labor can be looked upon as an addition to direct labor cost, the tax on indirect labor as a charge to manufacturing overhead and the tax on marketing and administrative payroll, a marketing and administrative expense. However, the prevailing practice is to charge manufacturing overhead for all payroll taxes on factory direct and indirect labor similar to the procedure used in dealing with compensation insurance. The payroll taxes attributable to marketing and administrative salaries are treated as marketing and administrative expenses.

Using the payroll information shown in the previous journal entry, a journal voucher could be prepared showing:

Manufacturing Overhead		$3,150.00	
Federal Old Age Benefits Tax	$1,050.00		
Federal Unemployment Insurance Tax	210.00		
State Unemployment Compensation	1,890.00		
Federal Old Age Benefits Tax Payable			$1,050.00
Federal Unemployment Insurance Tax Payable			210.00
State Unemployment Compensation Tax Payable			1,890.00

To set up liability for employer's payroll tax for month of ——.

The entry resulting from the decision to charge payroll taxes accrued on direct labor as an additional labor charge would be as follows:

Work in Process—Direct Labor	$2,000.00	
Manufacturing Overhead—Indirect Labor	1,150.00	
Federal Old Age Benefits Tax Payable		$1,050.00
Federal Unemployment Insurance Tax Payable		210.00
State Unemployment Compensation Tax Payable		1,890.00

The figures used in the debits to Work in Process and Manufacturing Overhead have been arbitrarily determined for the purpose of this illustration.

Labor Distribution Entry. To carry the illustration on page 208 further, the same company shows a distribution entry in the following form:

Work in Process—Direct Labor	$77,500.00	
Manufacturing Overhead—Indirect Labor	21,000.00	
Engineering Overhead	6,000.00	
Sales Expense	2,500.00	
Administrative Expense	2,500.00	
Time Study Expense	500.00	
Payroll		$110,000.00

To record labor distribution for the month.

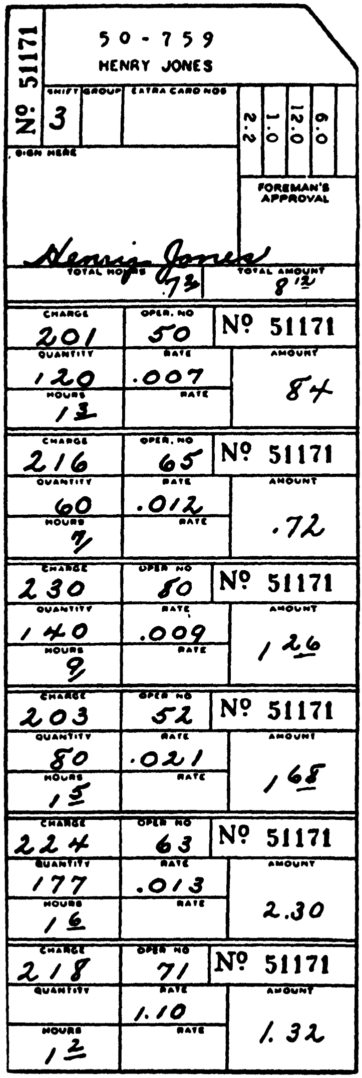
Short Cuts in Labor Costing. The possibility of simplifying labor cost routine is one that must be studied anew in each plant. The major possibilities in this respect are:

1. Combining payroll and timekeeping records
2. Use of mechanical equipment to produce several required records in a single operation
3. Use of various types of mechanical equipment to simplify timekeeping and cost routine by preprinting standard information on time tickets, by abolition of time tickets, etc.

Combining Clock Record and Labor Distribution. Conventional methods call for in-and-out clock record and use of separate time tickets. This makes it necessary for two sets of clerks to handle the records and then to reconcile the figures obtained by each section. By combining both types of record into a single form, reconciliation of labor charges and payroll earnings becomes automatic. Figure 61 is an example of such a combination, but in order to make it more flexible, the different sections of the ticket are arranged in the form of detachable stubs. This is illustrated by Figure 62 which shows, by means of clock punchings, that the employee in question worked 7.2 hours. The time stubs also add up to the same number of hours, thus providing an automatic check on the accuracy of earnings and the labor distributions.

After the time has been checked and approved by the foreman, the tickets are sorted by employees within departments and earnings posted to employees' earnings cards. The cost coupons are then separated and sorted by departments and account charges. The resulting figures are next posted to a departmental labor distribution sheet. The sum total of all the charges in all departments must again be balanced against the payroll control sheet. At the end of the month, labor charges are totaled by adding the columns on the labor distribution sheets. Grand totals for the labor distribution sheets, payroll control sheet, and employees' earnings cards are now in balance.

Another form of combining payroll and labor distributions is to produce the figures for each in a single operation. Use of mechanical equipment predominates in such cases. It can be done through the use of peg boards or various machines developed from the adding machine, the typewriter, and the cash register. All these devices are equipped with special form-feeding mechanisms to handle payroll and, where desired, labor distributions. What the machine does is to accumulate



Nº 51171

50 - 759
HENRY JONES

SHIFT	GROUP	EXTRA CARD NOS					
3			2.2	1.0	12.0	6.0	

SIGN HERE Henry Jones

FOREMAN'S APPROVAL

TOTAL HOURS $7^{\underline{2}}$

TOTAL AMOUNT $8^{\underline{12}}$

CHARGE	OPER. NO	Nº 51171
201	50	
QUANTITY	RATE	AMOUNT
120	.007	84
HOURS	RATE	
$1^{\underline{3}}$		

CHARGE	OPER. NO	Nº 51171
216	65	
QUANTITY	RATE	AMOUNT
60	.012	.72
HOURS	RATE	
7/		

CHARGE	OPER NO	Nº 51171
230	80	
QUANTITY	RATE	AMOUNT
140	.009	$1^{\underline{26}}$
HOURS	RATE	
9/		

CHARGE	OPER NO	Nº 51171
203	52	
QUANTITY	RATE	AMOUNT
80	.021	$1^{\underline{68}}$
HOURS	RATE	
$1^{\underline{5}}$		

CHARGE	OPER NO	Nº 51171
224	63	
QUANTITY	RATE	AMOUNT
177	.013	2.30
HOURS	RATE	
$1^{\underline{6}}$		

CHARGE	OPER NO	Nº 51171
218	71	
QUANTITY	RATE	AMOUNT
	1.10	1.32
HOURS	RATE	
$1^{\underline{2}}$		

FIGURE 62. Combined Clock Record and Cost Coupons

labor distributions while payroll data are fed into it. When the payroll forms have been completed, totals of labor distributions are automatically obtained from the registers contained in the machine.

Another mechanical approach to the problem requires the use of punched cards which are fed into sorting and tabulating machines. The former sort the cards to any desired groups or classes while the tabulators produce the totals for each group or subgroup.

QUESTIONS

1. What distinction is there between direct labor and indirect labor?
2. What is the relationship between timekeeping, payroll accounting, and cost accounting?
3. It should be evident that labor costing involves extensive record keeping. Discuss the following short cuts in labor costing:
   a) Combining payroll and timekeeping records manually prepared
   b) Mechanical equipment to produce the required records in a single operation
   c) Abolition of time tickets
   d) Keysort cards
   e) Punched cards
4. What are the arguments for and against (*a*) accruing vacation pay during the fiscal year, (*b*) during the period in which the employee qualifies for vacation?
5. Should overtime and night shift bonuses for direct workers be treated as a direct labor charge or included as overhead? Discuss the merits of each method.
6. What is the purpose of the labor distribution sheet?
7. Explain the cost accounting treatment of payroll taxes levied upon and paid by the employer.
8. Assume a factory shut down of two weeks for the vacation period. Discuss the cost accounting treatment of the vacation pay as well as the fixed manufacturing overhead of the plant for the two-week period.
9. List the steps in accounting for labor costs.
10. Some cost accountants maintain that in process costing there is no distinction between direct and indirect labor. Do you agree? Explain.
11. The costing of labor is essentially the step of functionalizing the entry for payroll made in the voucher register. Explain by illustrative pro-forma journal entries.
12. Should a company which operates a job order cost system charge overtime to the orders on which the overtime work is done or should the overtime be charged to an overhead account and distributed to all orders worked on during the period?

Chapter 11

ACCUMULATION OF MANUFACTURING OVERHEAD

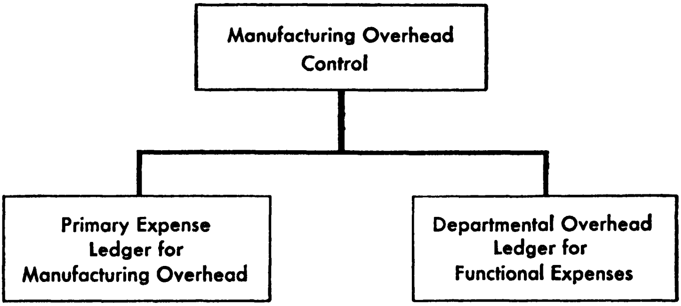
Manufacturing Overhead. Manufacturing overhead embodies all items of production cost exclusive of raw materials and direct labor. The latter two items combined are termed prime cost. Superimposed upon prime cost is a class of indirect or general expenses which, though pertaining to manufacturing, cannot be charged directly to the product. These expenses are termed manufacturing overhead or burden. For example, in the manufacture of bronze bushings to customer specifications, the raw material cost of bronze castings can be definitely ascertained. Likewise direct labor cost involved in machining castings can be computed. But it is impossible to identify as part of the cost of these bushings the exact cost of supervision, production control, power, and many other services all of which are essential elements of a well-organized plant.

The term burden is commonly used as a synonym for manufacturing overhead. It is a collective term that includes all items of manufacturing expense. Other synonyms are factory expense, plant expense, plant and service expense, factory overhead, and oncost. By whatever name the expenses are known, they represent one of the most important topics in the field of cost accounting.

A distinction must be made between actual and applied overhead. Because of reasons to be explained in a later chapter, actual overhead is rarely charged to the product through Work in Process. Instead it is customary to use so-called overhead rates which may be established on the basis of actual or predetermined expenses. Through the use of these rates overhead may be charged or, in the technical phrase, applied to the product in the first instance. The amount so applied is then compared at convenient intervals with the actual or historical expenses. It is clear therefore that *indirectly* the actual overhead is reflected in product costs through the overhead rates, and for this reason the actual overhead is frequently referred to, in the literature of cost accounting, as indirect expense.

Accounting for Manufacturing Overhead. There are four steps in accounting for manufacturing overhead. The first is concerned with the proper accumulation of expenses in primary accounts. These are the natural accounts representing objects of expenditure. The second step distributes the primary accounts to departmental accounts. This is a process of *functional* classification of accounts on the basis of the purpose achieved or function performed. The third step, which in a sense is quite independent of the other two, is the application of the overhead to the product by charging work in process at the appropriate overhead rate. The fourth step consists of disposing of the difference between actual and applied overhead, i.e., the overapplied or underapplied expense, through any one of a variety of methods. In this chapter the accounting for actual overhead only is being considered. Consideration of steps two, three, and four mentioned above is deferred to the next two chapters.

Controlling Account. Since even a rough subdivision of accounts produces a great many of them it is best to keep them in a subsidiary ledger which for convenience is referred to as a primary expense ledger or manufacturing overhead ledger. Similarly, it is considered good practice to establish a subsidiary departmental overhead ledger whenever the number of departments becomes large. In this way the major ledgers are relieved of a great many accounts, both primary and departmental. The relationships may be illustrated as follows:


Manufacturing Overhead Control
Primary Expense Ledger for Manufacturing Overhead
Departmental Overhead Ledger for Functional Expenses

Note that there is one controlling account for the two ledgers. The same information is contained in both, but it is arranged in different ways. By the use of special devices it is possible to combine the two subsidiary ledgers into one, but in general a separation of the two is advisable. The primary expense ledger furnishes the basic information concerning actual overhead for use in operating statements, particularly those intended for external consumption. The departmental overhead ledger is of special interest to foremen, supervisors, and top management since it furnishes the data concerning the costs of operating the various departments.

Primary Expenses

Subdivision of Primary Expenses. A typical subdivision of primary manufacturing overhead is shown below. It is part of the official classification recommended for use in the electrical manufacturing industry.

31. Salaries and Wages
32. Operating Supplies
33. Other Factory Expenses
34. Rendered Service
35. Maintenance
36. Fixed Charges
37. Power, Heat, and Light
38. Sundry Expenses

The above accounts are major primary account groupings which require further subdivision and even sub-subdivision, as shown in Figure 63.

Controversial Manufacturing Overhead Items. A divergence of opinion exists among accountants and managers in industry with respect to certain manufacturing overhead items. The principal controversial items are as follows:

1. Administrative expense
2. Interest on plant investment
3. Depreciation on basis of reproduction cost value instead of on original cost basis
4. Depreciation on assets fully written off
5. Taxes of various classifications

General Administrative Expense. Many authorities contend that the primary functions of an industrial company are production and distribution; and that administration is merely a service, a facilitating function. Under this position, costs of administering a business are allocated or apportioned between production and distribution in line with administrative time and effort devoted to each of the two primary functions. By allocating a portion of general administrative expense to manufacturing, the expenses of the latter function are increased. This increase must eventually be reflected in higher overhead rates which find their way through the Work in Process account into work in process, finished parts, and finished goods inventories, before winding up in cost of sales. It is readily seen, therefore, that administrative expenses are capitalized to the extent that they are charged to inventories.

Interest on Invested Capital. Except for comparative cost purposes, discussed in a later chapter, there are today few accountants who

Subgroup 31. Salaries and Wages

- 311 Supervision
  - 3111 Supervision
  - 3112 Foreman and Assistants
  - 3113 Inspectors
- 312 Clerical Employees
- 313 Service Employees
  - 3131 Elevator and Crane Operators
  - 3132 Stockkeepers and Helpers
  - 3133 Tool Cut Attendants
  - 3134 Helpers and Laborers
  - 3135 Railway Employees
  - 3136 Chauffeurs and Garagemen
  - 3137 Overtime Allowances

Subgroup 32. Operating Supplies

- 321 Fuel Consumed
- 322 Nondurable Tools
- 323 Shop Supplies
- 324 Inspection and Supplies for Lighting and Electrical Equipment
- 325 Office Supplies

Subgroup 33. Other Factory Expenses

- 331 Personal Service
  - 3311 Accident Service
  - 3312 Hospital Service
  - 3313 Employees' Education and Work
  - 3314 Employees' Representative
  - 3315 Employees' Suggestion Awards
  - 3316 Employment Bureau
  - 3317 Personnel Service Research
  - 3318 Restaurant Operations
  - 3319 General Welfare
- 332 Unassigned Transportation and Packing (Incoming)
- 333 Packing (Outgoing)
- 334 Shop Losses
- 339 Sundry Other Manufacturing Expenses
  - 3391 Rearrangement of Equipment
  - 3392 Telephone and Telegraph
  - 3393 Traveling Expense
  - 3394 Plant Protection
  - 3395 Grounds and Gardens
  - 3396 Instruction of Apprentices
  - 3397 Other Manufacturing Expenses

Subgroup 34. Rendered Service

- 341 Purchasing Department
- 342 Receiving Department
- 343 Storeskeeping Department
- 344 Shipping Department

Subgroup 35. Maintenance

- 351 Building and Structure
  - 3511 Office Buildings
  - 3512 Other Buildings
  - 3513 Structures
  - 3514 General Service, Piping, and Wiring
- 352 Machinery and Tools
  - 3521 Machinery
  - 3522 Electrical Apparatus
  - 3523 Ovens and Furnaces
  - 3524 Conveyor Equipment
  - 3525 Small Tools
  - 3526 Electrical Accessories
  - 3527 Molds, Pegs, Punches, Dies, and Special Tools
  - 3528 Metal Flasks
- 353 Foundations
  - 3531 Foundations for Machinery and Electrical Apparatus
- 354 Furniture and Fixtures
  - 3541 Factory Fixtures and Equipment
  - 3542 Furniture and Appliances in Factory Office
- 355 Transportation System
  - 3551 Roads and Sidewalks
  - 3552 Railway Tracks and Overhead Equipment
  - 3553 Rolling Stock
  - 3534 Automobiles and Trucks (Gas)
  - 3555 Electric Vehicles and Trailers
  - 3556 Other Conveyances
- 356 Patterns

Subgroup 36. Fixed Charges

- 361 Depreciation
- 362 Taxes
- 369 Other Fixed Charges
  - 3691 Insurance, Property
  - 3692 Rentals
  - 3693 Accident Compensation
  - 3694 Shop Vacation Allowance
  - 3695 Group Insurance
  - 3696 Supplementary Compensation
  - 3697 Taking Inventories
  - 3698 Establishment Charges Liquidated
  - 3699 Pensions

Subgroup 37. Power, Heat, and Light

- 371 Operating Employees
  - 3711 Supervision
  - 3712 Clerical Employees
  - 3713 Service Employees
- 372 Operating Supplies
  - 3721 Fuel Consumed
  - 3722 Steam
  - 3723 Water
  - 3724 Lubricants
  - 3725 Nondurable Tools
  - 3728 Other Supplies
- 373 Maintenance
  - 3731 Buildings
  - 3732 Steam Plants
  - 3733 Engines and Turbines
  - 3734 Electrical Plant
  - 3739 Other Maintenance
- 374 Fixed Charges
  - 3741 Depreciation
  - 3742 Taxes
  - 3743 Insurance
  - 3744 Rentals
  - 3745 Assessed Charges
- 379 Other Operating Expenses

Subgroup 38. Sundry Expenses

- 381 Assessed Charges
- 382 Expense Credits

Figure 63. Subdivision of Primary Expense Accounts

believe in the propriety of charging interest on investment, imputed interest as it is called, as part of the cost of production. Such imputed interest may be an important factor where large inventory values are tied up for long periods, as is the case in aging processes for tobacco inventories, bonded liquor, etc. Advocates of the scheme are found among economists who maintain that each factor of production, land, labor, and capital must have its reward in the form of rent, wages and salaries, and interest, respectively, before there can be any talk of profits. The case for inclusion of interest has been well stated by the Cotton-Textile Institute, Inc.:[1]

> Believing that the continued operation of a manufacturing enterprise which persistently fails to return a normal current rate of interest on the investment is economically unsound, that an industry generally so situated could not hope to attract new capital, and that investors are not justified in incurring the risks incident to the conduct of a manufacturing enterprise unless its returns exceed current interest rates, we have included in the overhead budget a charge for interest at 6% on the amount of capital normally required in the conduct of the business.
>
> The details of the development of the interest charge consist of determining the value of the normal inventories of cotton, stock in process, finished goods, supplies, cash, etc., which a conservative estimate would indicate as the minimum necessary for efficient conduct of the business. Interest at 6% is then computed on the principal amount thus established. All of this interest charge is distributed as an item of overhead. . . .

However, interest on investment is not a deductible expense for the purpose of computing federal income taxes, and if included in the accounts would have to be eliminated when preparing the tax returns. The best thought seems to lean to the idea that if such interest is to be shown at all, it should be treated as a partial distribution of net profits rather than as a charge to cost of production. This would involve an analysis of net profit into its component elements in order to reveal to management the relative earning capacity of the business. Thus if the net profits amounted to $100,000, such an analysis might be presented as follows:

Net profits per books	$100,000
Less interest on investment (6% on $1,000,000)	60,000
True profits of business	$ 40,000

With this sort of analysis management is immediately put on notice that 60% of the profits of the business are really a return on the investment, something that could presumably be earned elsewhere without undertaking entrepreneurial risks. Thus the true earning capacity of the business is revealed to be only $40,000.

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[1] *A Method for Predetermining Costs in Cotton Yarn Mills*, 1930, p. 41.

It must be understood that if interest is actually charged in the accounts, it is capitalized and thus produces a profit figure different from the situation when no interest is charged.

Depreciation on Reproduction Cost. In place of the interest controversy a new controversy has arisen. This is concerned with depreciation on replacement value instead of on the traditional cost basis. The idea is not precisely new but has been given increased significance as a result of inflationary pressures generated in the years immediately following World War II. Briefly, the argument is to the effect that because of greatly increased prices for capital goods, the business must recover in its selling price, through the depreciation charge, the replacement value of such goods during their service life. Failure to increase the depreciation charge to compensate for the increased cost of replacement, it is argued, overstates the profits during the expansion phase of the business cycle. Since an increase in price has the effect of decreasing the purchasing power of money, it is contended that the profits are largely illusory, that they give, in other words, the impression of being larger than they really are. Thus the increased prices of both capital and consumer goods and the decrease in the purchasing power of the dollar are really two aspects of the same thing, the effect being to make the profits appear larger than they really are.

Against the above arguments must be urged two main considerations. The first is to the effect that many responsible accounting bodies, notably the American Institute of Accountants, have repeatedly urged adherence to the *cost* basis for depreciation and valuation.[2] In fact, the Institute has stated that depreciation is a process of *allocation,* not of *valuation,*[3] meaning that the purpose of the depreciation charge is to assign, that is, allocate, to the different accounting periods their shares of the *original cost* of the asset. Second, it cannot be repeated too often that depreciation accounting has nothing to do with replacement of assets. The latter is a matter of prudent fiscal policy pursued by top management, including the board of directors and the executive committee. Whether depreciation is recorded on the books of the business on the basis of historical cost or replacement value, or whether it is recorded at all has nothing to do with the physical replacement of the asset. The biggest depreciation reserve in the world cannot buy a morning newspaper, let alone new machinery and buildings. Only cash or promises to pay cash can replace new assets.

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[2] *Accounting Research Bulletin 33,* also memorandum of October 4, 1948.

[3] *Accounting Research Bulletin 20* (Special).

The desire to recover in the selling price of the product the present high costs not only of fixed assets but of material, labor, and services is a valid objective. It rests on a basic postulate in accounting of matching costs of a period against revenues of the same period. To the extent that assets are retired and replaced with higher-priced equipment, this objective is in fact realized, since the replacement value becomes the actual cost. To the extent that buildings, machinery, and equipment need replacement a year or five years or ten or fifteen years from now, the argument is invalid, since there is no assurance that present high costs will prevail in the future; nor does it consider technological changes. In fact, should prices of durable producers' goods fall, the whole question of depreciation on replacement value would become academic. Whether or not the company has increased its depreciation charges, increased selling prices during the expansion phase of a business cycle do take place, and hence these increases *may* provide the sinews for the replacement of assets.

Another argument for depreciation charges based on increasing replacement costs urges that in this way less funds are available for dividends. However, this argument fails when it is remembered that a business can dissipate resources in many ways other than through payment of dividends. It may spend money on increased salaries for officers or on excessive advertising particularly of the institutional type. The net result may well be that even with increased depreciation there may be no funds when the time for asset replacement arrives.

In summary, it may be said that the cost basis for depreciation is a logical one, that it produces results in conformity with "generally accepted principles of accounting" and is consistent from year to year. The replacement value basis produces fluctuating depreciation charges. It may be used *outside the records* for purposes of determining selling prices of goods and in cases of sale of the property itself. In such cases an appraisal by responsible appraisers furnishes the needed data.

Depreciation on Assets Fully Written Off. Many writers in the field of accounting theory have from time to time posed the problem of depreciation on assets which have already been written off through regular depreciation charges but which are still functioning. The approach has been mainly by way of the accounting and bookkeeping problems involved. Two suggestions have been offered:

1. Stop further depreciation. Once the asset is written off, no more depreciation should be taken. This is the position of the Internal Revenue Bureau.
2. Reappraise the life of the asset and restore the asset on the books in the light of the new facts.

World War II has given a new edge to the problem. Under so-called certificates of necessity, war contractors were permitted to amortize, that is, write off war plant facilities over a period of sixty months, or even less if the war lasted less than five years. In consequence, many manufacturers came out of the war with relatively new plants already written off against war contracts. These plants were in excellent condition and good for some years of service.

The argument most commonly presented in favor of restoring the asset on the books is that depreciation is part of the cost of an article; that without this charge the article is undercosted and therefore underpriced. In this way, the manufacturer of a depreciation-free plant has an unfair advantage for the remaining life of the plant over others who must perforce charge depreciation. On the other hand, it is argued that the profits are in reality smaller than they appear to be where no depreciation charge is made. Whether these arguments are valid can be answered only by referring again to the uses to which the resulting cost information is to be put. For profit and loss determination, including inventory valuation, the argument is merely another version of the interest on investment idea. It is up to management to analyze the profit picture, to ascertain the constituents of profit and the general background by which they were arrived at and to govern itself accordingly. As long as management realizes that no depreciation has been charged, it may then proceed to declare dividends or to set prices in the light of that knowledge. For purposes of budgeting, planning, and cost control it makes little or no difference whether depreciation is or is not charged. The main argument therefore centers around pricing and special situations. The fear is that by undercosting and underpricing his goods a manufacturer may spoil the market for the others in his industry and eventually even for himself. The argument is not nearly as strong as it may sound, since in many industries all competing manufacturers or certainly most of them were doing war work and amortizing their wartime facilities under certificates of necessity. The whole question shows once more the peculiar connection between accounting and economics in relation to the business community and the conflict between long-range and short-range viewpoints.

Taxes. Taxes as an element of manufacturing overhead whether related to real property tax on plant land and buildings or personal property taxes on equipment and inventories present no problem in their treatment in cost accounting. But the treatment of payroll taxes, income taxes, and sales and use taxes as parts of manufacturing overhead has yielded some differences of opinion. With regard to payroll taxes, most companies include these taxes either as manufacturing overhead or as general and administrative expense. Some companies treat the payroll tax on direct labor as an additional direct labor cost.

The American Institute of Accountants in Accounting Research Bulletin 23 indicates that income taxes are expenses which should be allocated as are other expenses. It can be argued from this that federal and state income taxes should be included as a part of cost by allocating a portion of these taxes to manufacturing overhead. However, most companies treat federal income taxes as "deductions from net profit before taxes" in the profit and loss statement.

The increased adoption of sales and use taxes by state and local governments justifies their consideration. Generally this type of tax attaches to some commodity or service. The general practice is to increase the cost or expense incurred by the amount of the tax. Where the tax is paid in connection with the acquisition of a fixed asset, it is capitalized in that asset.

Items Included in Manufacturing Overhead. Aside from the controversial items discussed above, there may still be some question as to what items should specifically be included in manufacturing overhead. The inclusion of certain items depends in the first instance on the limits of what are to be considered the manufacturing processes. Here it is entirely a question of the cutoff points. For example, does manufacturing overhead cease with the completion of the last operation, that is, with the completion of the product, or with its transfer to the finished goods stockroom, or after passing through the shipping room, or even at a later stage? The choice in each case depends somewhat on the nature of the industry and upon a concept of where responsibility for the expense is considered to rest. To some extent the answer depends also on the type of cost system. For instance, a plant doing primarily job order work might follow costs on a job through the shipping room and right up to the loading platform. In process plants it may be more convenient to cut off manufacturing overhead when the product is delivered to finished stock where it becomes the responsibility of the sales department.

Departmental Account Classification

Purpose of Departmentalization. A manufacturing plant is laid out along departmental lines primarily for production purposes, in order to:

1. Segregate basically different processes of production
2. Secure the smoothest possible flow of production
3. Establish lines of responsibility for physical control over production

In general, a manufacturing department is one in which manual and machine operations are performed directly upon any part of the commodities produced. These departments are also referred to as producing departments. More specifically, producing departments are those whose costs may be charged to the product because they have contributed directly to its production.

Service departments are those not directly engaged in production, but which render particular types of service for the benefit of other departments. In some instances, the services furnished benefit other service departments as well as the manufacturing departments. Note that commodities and jobs manufactured do not pass through service departments. But the expense incurred in the operation of service departments represents a part of the total manufacturing overhead that must eventually be absorbed in the product through the medium of overhead rates.

Names of manufacturing departments depend on the nature of the industry and the type of work performed. In a plate glass factory, the manufacturing departments are mixing, melting, polishing and grinding, wareroom-uncut stock, and wareroom-order cutting. The manufacturing departments in a cement mill are stone crushing, raw grinding and mixing, coal crushing and pulverizing, kiln burning and cooling, finish grinding and storing, and packing and loading.

In many cases, for cost application purposes, producing departments are subdivided to form cost centers. Where two or more operations are performed in a department, such subdivision increases the accuracy of overhead rates and product costs.

Names of service departments vary with the nature of service rendered. Some service departments are common to all industrial concerns, as, for example, storesroom expense, factory cost accounting, factory timekeeping, and payroll. Small plants may have only four or five plant service departments. As the size and scope of the plant increase, an expansion of service departments occurs to the point where a single company may have many service departments. Thus, a typical list might be as follows:

1. Steam Plant
2. Power Plant
3. Building Expense
4. Shop Maintenance
5. Engineering
6. Drafting
7. Inspection
8. Testing
9. Laboratory
10. First-Aid
11. Employment
12. Production Planning
13. Cost and Payroll
14. Tool Storage
15. General Factory Administration

Content of Departmental Overhead Accounts. For effective control of departmental operations it is necessary to subdivide the total expense of a department so as to localize costs. To this end, primary expense accounts are broken up and allocated to departmental accounts. Hence, a good many expense accounts are common to all departments. The following represents a simple classification of frequently used departmental expense items:

1. Superintendence
2. Inspection
3. Other indirect labor
4. Repairs
5. Indirect material
6. Factory supplies
7. Trucking
8. Light
9. Heat
10. Power
11. Taxes
12. Depreciation
13. Insurance
14. Miscellaneous

Again it must be emphasized that subdivision can take place to almost any degree desired. Thus, there may be half a dozen kinds of indirect labor; many items, such as repairs, taxes, depreciation, are subdivided to show separate operating costs of building and of machinery and equipment. Insurance may represent different kinds of coverage (fire, payroll holdup, or workmen's compensation) subdivided according to building insurance, insurance on equipment, and on inventories.

Recording Manufacturing Overhead

Overhead Accumulation. Manufacturing overhead accumulation refers to the procedures necessary to record the expenses in the double-entry records. Several steps are necessary to effect this:

1. Documentation; i.e., the preparation of original vouchers or documents to support the transaction
2. Entry in some journal
3. Posting to ledger (control account and subsidiary ledger)
4. Distribution of accounts by departments through analysis

For the purpose of explaining the procedure for overhead accumulation it may be convenient to classify overhead into the following four categories:

1. Indirect material
2. Indirect labor
3. Voucher register charges
4. Fixed charges

Indirect Material. Accounting for indirect materials is, in effect, a by-product of materials accounting. Briefly, the material requisitions, constituting the original documents, are sorted by direct and indirect material classifications and summarized on some form of summary of materials consumed. The latter forms the basis for a controlling journal entry in the factory journal charging, among others, Manufacturing Overhead and crediting Stores. The entry is posted in the usual way to these controlling accounts. In addition, the various stores accounts in the stores ledger are adjusted through the "issued" and "on hand" columns. An additional step is, however, necessary. First the indirect material requisitions must be sorted by supply account classifications, subtotaled, and posted to the primary expense ledger. Next, the same requisitions are analyzed by departments and posted to the departmental expense ledger. In place of the latter an overhead distribution sheet may be used. This sheet shows the primary overhead classifications and also the departmental charges in compact form and is illustrated in the next chapter.

In this way all steps have been taken to insure the complete accounting for indirect materials issued from stores. Indirect materials purchased directly for special use are treated below under voucher register charges.

Indirect Labor. This category too has already been covered in connection with labor distributions. In the case of indirect labor, the original document is the time ticket, clock card, or other evidence of time spent. Through the labor distribution, using the original documents, the charges to the appropriate accounts are established. Manufacturing Overhead is debited and some account such as Payroll Accrued or Factory Payroll credited. Detailed postings to the indirect labor classifications are then made in the primary overhead ledger and, after departmental analysis, to the departmental overhead ledger or to the overhead distribution sheet directly.

Voucher Register Charges. The next category of charges to manufacturing overhead comes through the voucher register or whatever medium is used to record purchases. So far as factory overhead items are concerned, they consist for the most part of direct purchases of materials and services. The former represent indirect materials and supplies ordered for use in a specific department. These do not go through the routine of being sent to the storeroom and then being requisitioned. An example in point is drafting room supplies. Purchased services are represented by purchased power, light, heat and repairs (if done by some outside agency).

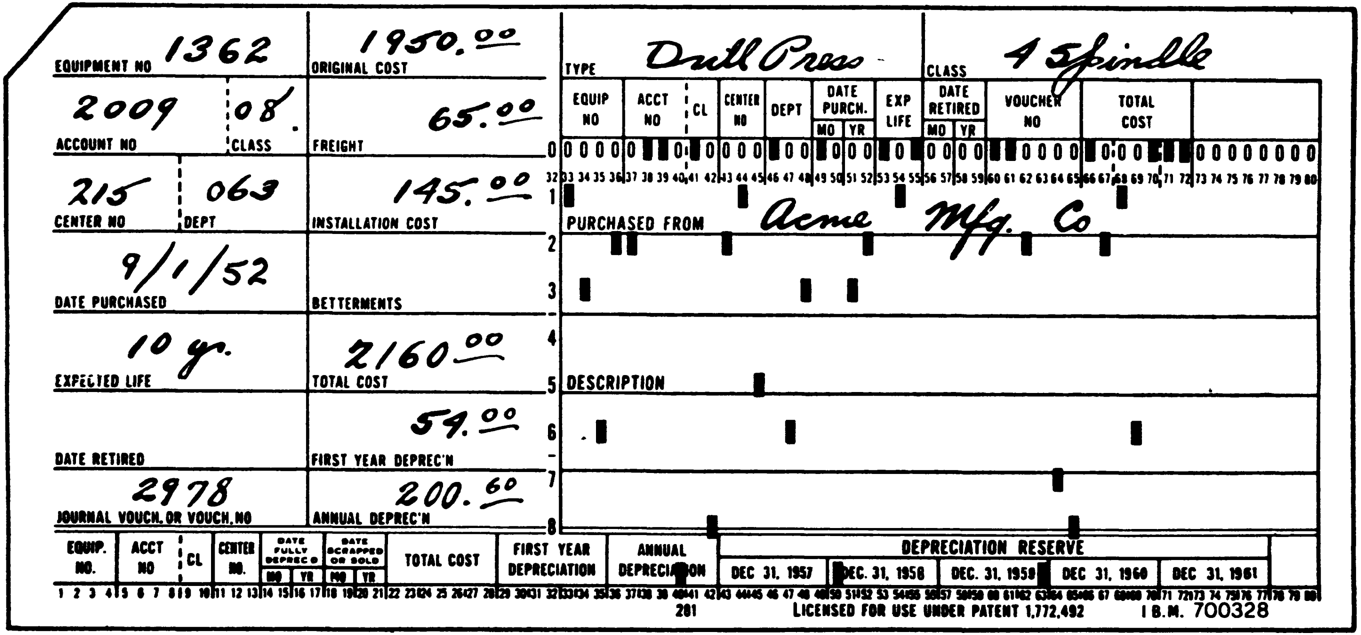
The accounting routine is analogous to the procedure explained in connection with the voucher register. Original evidences of the transactions are the vouchers authorizing the entries in the register. These vouchers are of course backed by purchase orders (except for such recurring items as light and power bills, rent, etc.), shipping documents and receiving reports. Before they can be entered, the following information must be at hand:

1. The control account to be charged (in this case Manufacturing Overhead)
2. The primary overhead account to be charged
3. The departmental distribution

The first two are ordinarily indicated on the voucher. The third item may or may not be shown on the voucher. If not, it is usually supported by a schedule showing the distribution. In the voucher register itself, there is ordinarily found a column for manufacturing overhead, subdivided into three parts for subaccount code, ledger folio, and amount. The control account is of course posted from the columnar total in the register in a lump sum at the end of the month. The subaccounts may be posted from day to day to the primary expense ledger. The departmental distributions, however, pose a problem. Where, as in the case of rent and power bills, only one invoice a month is received, the distribution can be indicated on the voucher in accordance with some prearranged plan. If, however, several invoices are received or expected during the month, affecting the same expense account, the distribution may be deferred to the end of the month in the interests of securing greater economy of time and effort. A detailed discussion of overhead distribution is reserved for the next chapter.

Depreciation. The basic source record for charging depreciation is the plant ledger, also referred to as a property ledger or plant and equipment ledger (Figure 64). It is usually kept by the general, not the cost, accounting department. Hence the latter depends on the general accounting department for its information. The equipment ledger card shows all information that has any bearing on the asset in question. This includes, among other items, a description of the asset, location of each unit of machinery and equipment, code number, and name. The purpose of this classification is to enable the cost department to allocate depreciation and property insurance to the proper departments when the monthly primary overhead distributions are made.

Each card shows a single unit of equipment and the entire set of cards is controlled on the general ledger by an account variously called Plant and Property, Buildings and Equipment, or Machinery and Equipment. The hand written information appearing on the card is punched into the card according to the code classification. This makes it possible to sort out quickly any desired information at any time. In many types



EQUIPMENT NO 1362

ACCOUNT NO 2009 | CLASS 08

CENTER NO 215 | DEPT 063

DATE PURCHASED 9/1/52

EXPECTED LIFE 10 yr.

DATE RETIRED

JOURNAL VOUCH. OR VOUCH. NO 2978

ORIGINAL COST 1950.00

FREIGHT 65.00

INSTALLATION COST 145.00

BETTERMENTS

TOTAL COST 2160.00

FIRST YEAR DEPREC'N 54.00

ANNUAL DEPREC'N 200.60

TYPE Drill Press

CLASS 4 Spindle

PURCHASED FROM Acme Mfg. Co

DESCRIPTION

EQUIP NO	ACCT NO	CL	CENTER NO	DEPT	DATE PURCH. MO	DATE PURCH. YR	EXP LIFE	DATE RETIRED MO	DATE RETIRED YR	VOUCHER NO	TOTAL COST

EQUIP. NO.	ACCT NO	CL	CENTER NO.	DATE FULLY DEPREC'D MO	DATE FULLY DEPREC'D YR	DATE SCRAPPED OR SOLD MO	DATE SCRAPPED OR SOLD YR	TOTAL COST	FIRST YEAR DEPRECIATION	ANNUAL DEPRECIATION	DEPRECIATION RESERVE DEC 31, 1957	DEC. 31, 1958	DEC. 31, 1959	DEC 31, 1960	DEC 31, 1961

281 LICENSED FOR USE UNDER PATENT 1,772,492 I B.M. 700328

FIGURE 64. Dual Tabulating Card for Property Accounting and Depreciation Accounting

of equipment records space is provided, either on the face or the reverse side, for memorandum entries covering maintenance. This is valuable statistical information and has a bearing on the general question of the expense of upkeep of the machine and the time of replacement of the asset.

It is to be noted particularly that the record shows the annual or monthly depreciation charge for each unit of equipment. This is vital information for the cost department. The general accounting department probably closes its books annually and hence makes only annual entries on the record. The cost department, however, must have the information monthly in order to prepare cost reports for use of management. Accordingly, the general accounting department sorts its cards by departments or cost centers and prepares for each department a list of equipment situated therein together with the original cost or other value and the amount of the monthly depreciation charge. On the basis of the latter information the cost department prepares a monthly journal voucher which may read as follows:

Manufacturing Overhead	$xx.xx	
Allowance for Depreciation—Machinery and Equipment		$xx.xx
To charge monthly depreciation on machinery and equipment.		

The above entry is posted in the usual way to the general accounts. In the primary overhead ledger, subaccount Depreciation on Machinery and Equipment is debited. In the departmental overhead ledger, the departmental subtotals on the equipment list are posted to their respective accounts. In this way all accounting requirements are satisfied. Similar analyses provide the information for charging depreciation on buildings and also on equipment used in the sales and general administrative departments.

It must of course be evident that the monthly preparation of the lists mentioned above is a tedious and time-consuming task, even where mechanical sorting of one kind or another is employed. Hence, in many instances the cost department uses the same figures for depreciation month after month with a final adjustment made at the end of the year based on exact figures revealed by the plant ledger. This is done in order to speed up monthly cost statements; also by using the same figures monthly, it is possible to prepare the depreciation journal vouchers *any time during the month* and have them posted and out of the way when the end of the month rush is on. Of course, by this means the monthly statements may be slightly inaccurate. The general accounting department, in an effort to secure greater exactness, may, however, issue from time to time revised lists containing two types of adjustments:

1. Monthly adjustments to depreciation schedules for changes in plant assets
2. Adjustments resulting from alterations, overhauls, and reappraisals

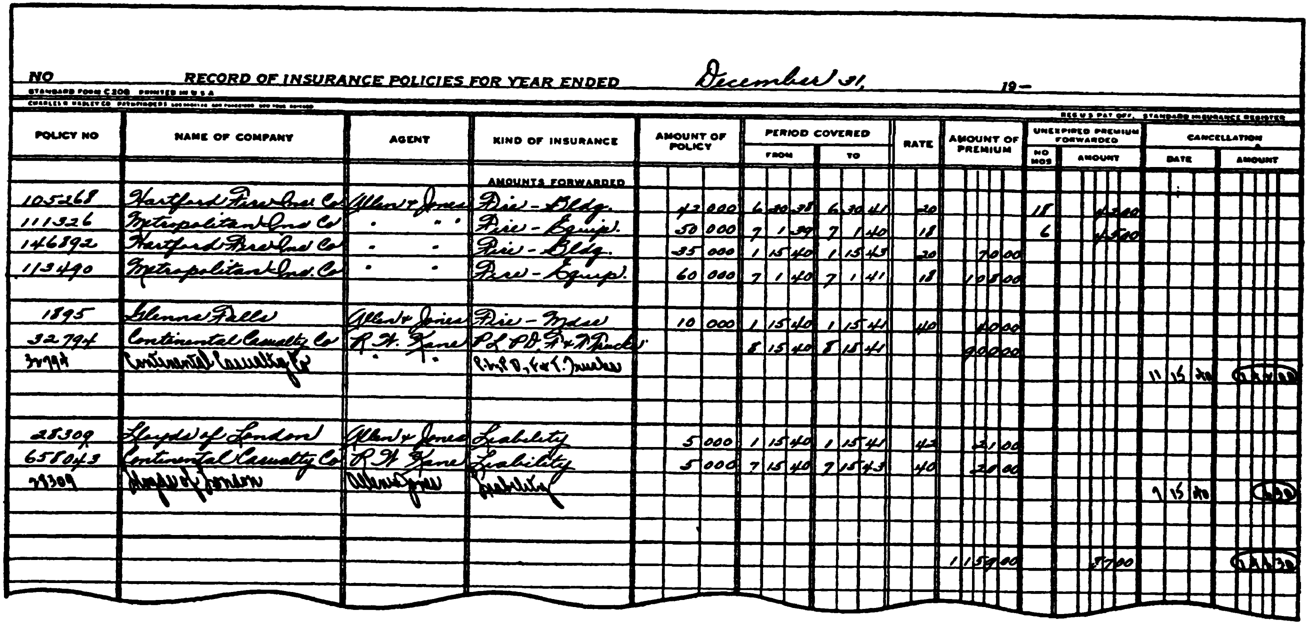
As to the first of these, it is a simple matter to add to the departmental lists the new equipment installed and remove the old equipment retired and thus arrive at a new valuation and depreciation for each department. Since asset changes in a particular department do not occur very often, this task is a minor one. The situation is a little more complex in the case of alterations, overhauls, and reappraisals either of asset values or of the estimated useful life.

In the case of alterations and overhauls it becomes a question of capitalizing or charging to revenue. The usual tests for capital charges apply here. For the sake of convenience many companies have established "house rules" for the guidance of the accounting personnel in deciding whether a given repair is to be considered a *period charge,* i.e., a charge to profit and loss, or whether it is to be capitalized. Thus, for example, one concern has established rules as follows:

1. Any asset expenditure (repair, purchase, etc.) amounting to $75 or less is to be automatically charged to revenue.
2. Over $75 but under $250, the chief accountant or other designated person is to decide whether to capitalize or charge to revenue.
3. Expenditures amounting to $250 or over are to be automatically capitalized.

Even with these rules there is always the possibility that the internal auditing section may decide a given case contrary to the rules announced in the company manual.

Insurance. An insurance register is necessary to provide a detailed record of each policy, to show the monthly write-off of prepaid insurance to expense, and to establish the expense distribution to the several divisions of the business. The form illustrated (Figure 65) provides all this information conveniently. Each group of policies relating to the same type of insurance coverage may be listed on a separate page, or, where there are not many policies, blocks of five or ten lines may be assigned to each group. In this way each page or each block on a page refers to a specific expense account, and analysis may be made by groups. The right half of the register provides space for a complete month-by-month record of write-offs and a final summary of total expired and total unexpired insurance at the end of the year. The sum of the last two items should, of course, equal the sum of the new insurance purchases and the total brought forward from the prior year. This provides a valuable check on the accuracy of the detailed computations.

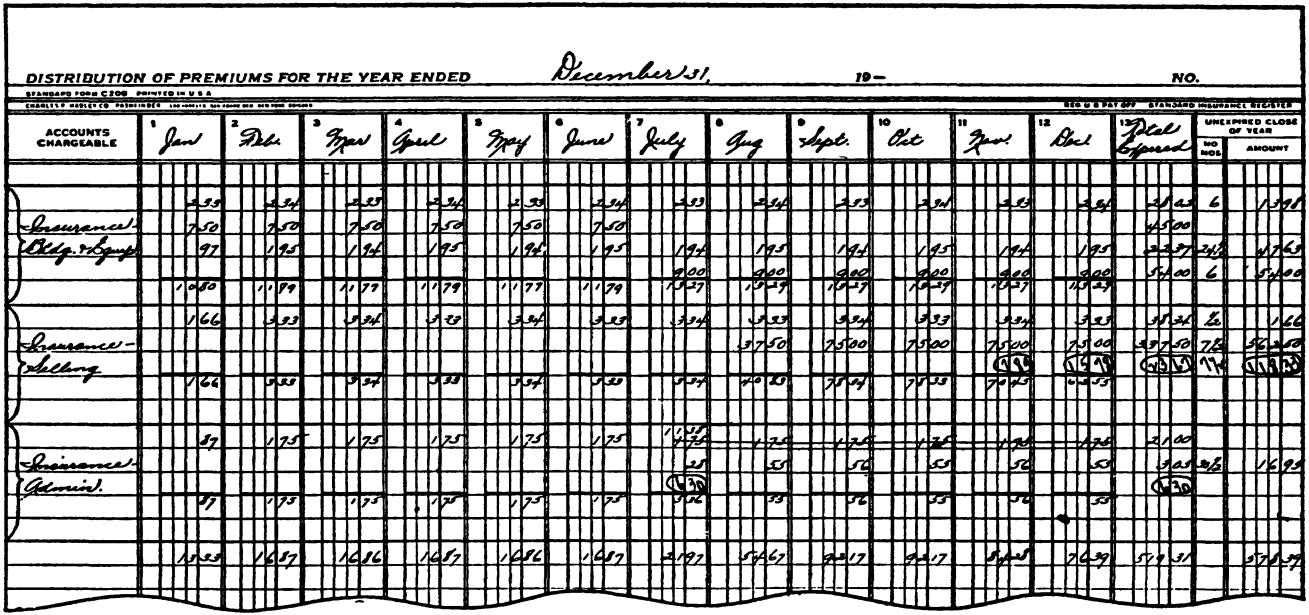


NO RECORD OF INSURANCE POLICIES FOR YEAR ENDED December 31, 19—

STANDARD FORM C 208 PRINTED IN U.S.A.

REG U S PAT OFF. STANDARD INSURANCE REGISTER

POLICY NO	NAME OF COMPANY	AGENT	KIND OF INSURANCE	AMOUNT OF POLICY	PERIOD COVERED FROM	PERIOD COVERED TO	RATE	AMOUNT OF PREMIUM	UNEXPIRED PREMIUM FORWARDED NO MOS	UNEXPIRED PREMIUM FORWARDED AMOUNT	CANCELLATION DATE	CANCELLATION AMOUNT
			AMOUNTS FORWARDED									
105268	Hartford Fire Ins Co	Allen & Jones	Fire - Bldg.	42 000	6 30 38	6 30 41	.20		18	42 00		
111326	Metropolitan Ins Co	" "	Fire - Equip.	50 000	7 1 39	7 1 40	18		6	45 00		
146892	Hartford Fire Ins Co	" "	Fire - Bldg.	35 000	1 15 40	1 15 43	.20	70 00				
113490	Metropolitan Ins. Co	" "	Fire - Equip.	60 000	7 1 40	7 1 41	18	105 00				
1895	Glenns Falls	Allen & Jones	Fire - Mdse	10 000	1 15 40	1 15 41	40	40 00				
32794	Continental Casualty Co	R. H. Kane	P.L. P.D. F & T Trucks		8 15 40	8 15 41		900 00				
32794	Continental Casualty Co	" "	P.L., P.D., F & T. Trucks								11 15 40	[illegible]
28309	Lloyds of London	Allen & Jones	Liability	5 000	1 15 40	1 15 41	42	21 00				
658043	Continental Casualty Co	R H Kane	Liability	5 000	7 15 40	7 15 43	40	20 00				
28309	Lloyds of London	Allen & Jones	Liability								9 15 40	[illegible]
								1 159 00		87 00		[illegible]



DISTRIBUTION OF PREMIUMS FOR THE YEAR ENDED December 31, 19— NO.

STANDARD FORM C208 PRINTED IN U.S.A.

CHARLES R. HADLEY CO. — REG. U.S. PAT. OFF. STANDARD INSURANCE REGISTER

ACCOUNTS CHARGEABLE	1 Jan	2 Feb.	3 Mar	4 April	5 May	6 June	7 July	8 Aug	9 Sept.	10 Oct	11 Nov.	12 Dec	13 Total Expired	UNEXPIRED CLOSE OF YEAR NO. MOS.	AMOUNT
Insurance—Bldg. & Equip.	2 33	2 34	2 33	2 34	2 33	2 34	2 33	2 34	2 33	2 34	2 33	2 34	28 02	6	13 98
	7 50	7 50	7 50	7 50	7 50	7 50							45 00		
	97	1 95	1 94	1 95	1 94	1 95	1 94	1 95	1 94	1 95	1 94	1 95	22 37	24½	47 63
							9 00	9 00	9 00	9 00	9 00	9 00	54 00	6	54 00
	10 80	11 79	11 77	11 79	11 77	11 79	13 27	13 29	13 27	13 29	13 27	13 29			
Insurance—Selling	1 66	3 33	3 34	3 33	3 34	3 33	3 34	3 33	3 34	3 33	3 34	3 33	38 34	½	1 66
								37 50	75 00	75 00	75 00	75 00	337 50	7½	562 50
											(7 89)	(15 78)	(23 67)	7¾	(118 33)
	1 66	3 33	3 34	3 33	3 34	3 33	3 34	40 83	78 34	78 33	70 45	62 55			
Insurance—Admin.	87	1 75	1 75	1 75	1 75	1 75	1 05 1 75	1 75	1 75	1 75	1 75	1 75	21 00		
							25	55	56	55	56	55	3 02	3½	16 95
							(1 30)						(1 30)		
	87	1 75	1 75	1 75	1 75	1 75	56	55	56	55	56	55			
	13 33	16 87	16 86	16 87	16 86	16 87	17 17	54 67	92 17	92 17	84 28	76 39	579 31		578 59

FIGURE 65. Insurance Register

With a register of the type shown in Figure 64 it is necessary to start a new one each year by bringing forward unexpired time and dollar balances from the old to the new register. The advantage of the twelve monthly columns is that they automatically provide the amount of monthly expiration, since the totals for each month are likely to vary.

Expenditures for insurance premiums for all types of coverage are charged to a Prepaid Insurance account. The insurance register furnishes monthly the information for the journal voucher debiting Manufacturing Overhead and crediting Prepaid Insurance. The voucher indicates which subaccount or accounts are to be charged in the primary overhead ledger. Because of the many different kinds of insurance coverage requiring different departmental distributions, special work sheets may become necessary.

Workmen's compensation insurance is handled in a special way. An employer who buys such coverage is asked by the insurance company to estimate the annual payroll for each type of occupational risk. On the basis of this estimate the insurance company calculates an advance premium and issues the policy. Two or more times during the policy year a payroll auditor representing the underwriter verifies the figures and in due time the insurance company adjusts the premium figure. Many companies underestimate their payroll figures in order to minimize the advance premium; hence, the adjustment is usually in the form of an additional bill. A simple example of how the additional premium is calculated follows:

Estimated Payroll for the Year June 1, 1952 to June 1, 1953

	Payroll	Rate per 100	Amount
Class A	$12,000.00	$4.29	$514.80
Class B	6,000.00	3.25	195.00
Class C	3,000.00	.75	22.50
Totals	$21,000.00		$732.30

On December 1, 1952 the payroll auditor ascertains the following facts:

Month	Class A	Class B	Class C	Total
June	$ 2,100.00	$1,000.00	$ 700.00	$ 3,800.00
July	2,200.00	1,200.00	900.00	4,300.00
August	2,400.00	1,400.00	800.00	4,600.00
September	2,300.00	1,500.00	1,100.00	4,900.00
October	2,600.00	1,800.00	1,200.00	5,600.00
November	2,800.00	1,800.00	1,300.00	5,900.00
	$14,400.00	$8,700.00	$6,000.00	$29,100.00
Rates per $100	$ 4.29	$ 3.25	$ .75	–
Adjusted premium . .	$ 617.76	$ 282.75	$ 45.00	$ 945.51

The additional premium due is then calculated as follows: On the basis of the actual payroll figures the total premium amounts to $945.51. Because six months have elapsed since the issuance of the policy, one half of the advance premium ($366.15) may be applied against the amount due. Hence the company will receive a bill for additional premium covering the first six months of $579.36 (the difference between $945.51 and $366.15). This invoice after audit and vouchering is then entered in the usual way charging Insurance Prepaid and crediting Vouchers Payable. At the end of each month, specially prepared work sheets furnish the figures for the monthly expirations of insurance including workmen's compensation. Assuming, for the sake of illustration, that no other insurance is being carried, the work sheet for the monthly expirations would appear as in Figure 66. These are computed on the basis of historical figures at the regular premium rates. When the expirations and the additional premium are posted, the ledger account would then appear as follows:

INSURANCE PREPAID

6/1	Advance payment .	$ 732.30	6/30	Expired	$ 127.84
11/30	Additional payment .	579.36	7/30	" . .	140.13
			8/30	"	154.46
			9/30	"	155.67
			10/30	" . . .	179.04
			11/30	" . . .	188.37
				Balance	366.15
		$1,311.66			$1,311.66
12/1	Balance	$ 366.15			

It is apparent therefore that on December 1 the prepaid account shows the correct prepayment of compensation insurance. However, prior to the entry of the additional premium, the account showed a credit balance. This was because the debit side was based on an estimated payroll, the credit side on actual figures. In addition the accounts reflect a liability for the additional premium and, of course, Manufacturing Overhead and other controls are debited monthly for the respective expirations. Finally the monthly expirations are distributed to departmental accounts as explained in the next chapter.

An alternative to the method demonstrated above is to calculate an average premium rate and apply it to the *estimated actual* payroll each month. This method is particularly favored where monthly journal vouchers are prepared in advance. It necessitates, of course, an adjustment whenever the books are closed.

Taxes. The taxes discussed under this heading are those that may generally be considered as either operating expenses or part of the cost

Class of Labor	June		July		August		September		October		November	
	Payroll	Expired Premium	Payroll	Expired Premium	Payroll	Expired Premium	Payroll	Expired Premium	Payroll	Expired Premium	Payroll	Expired Premium
Class A .	$2,100.00	$ 90.09	$2,200.00	$ 94.38	$2,400.00	$102.96	$2,300.00	$ 98.67	$2,600.00	$111.54	$2,800.00	$120.12
Class B .	1,000.00	32.50	1,200.00	39.00	1,400.00	45.50	1,500.00	48.75	1,800.00	58.50	1,800.00	58.50
Class C .	700.00	5.25	900.00	6.75	800.00	6.00	1,100.00	8.25	1,200.00	9.00	1,300.00	9.75
Totals . .	$3,800.00	$127.84	$4,300.00	$140.13	$4,600.00	$154.46	$4,900.00	$155.67	$5,600.00	$179.04	$5,900.00	$188.37

FIGURE 66. Work Sheet Showing Monthly Insurance Expirations for Workmen's Compensation Insurance

of production. This would exclude therefore all taxes based on income as well as sales and excise taxes for which the concern acts as merely a collecting agent. It does, however, include the so-called payroll taxes, representing the social security deductions made by the employer and also the amounts contributed by him.

The most common taxes take the form of a tax on real and personal property. These are generally levied by municipalities on the basis of annual assessment rolls and published rate schedules. When the tax bill is received it is charged against an accrued tax account. Meanwhile the cost department must prepare a monthly journal voucher calculating the tax applicable. The controlling entry might take the following form:

Manufacturing Overhead	$xx.xx	
Marketing Expense	xx.xx	
General Administrative Expense	xx.xx	
Taxes Accrued		$xx.xx
To accrue real and personal property taxes for the month of ——.		

After postings to the general ledger are completed, postings to the primary overhead ledger are in order. In the manufacturing overhead ledger, there may be one or more expense accounts for taxes depending on the degree of subdivision desired. After that, departmental distributions are required.

By following the above procedure it is evident that sometime during the year there is a debit balance in the account, at other times a credit balance. For example, bills may be sent out by the taxing authority in March of each year covering the tax for the entire calendar year, the tax being payable in two instalments in April and October. A voucher is therefore entered in April debiting Taxes Accrued for one half the amount. This covers the tax accrual from January 1 to June 30. Monthly the cost department, as explained above, accrues the tax. The account therefore appears as follows:

TAXES ACCRUED

4/1	R. E. tax, first half	$600.00	1/31	Accrued	$100.00
			2/28	"	100.00
			3/31	"	100.00
			4/30	"	100.00
			5/31	"	100.00
			6/30	"	100.00

At the end of March a liability of $300 is accrued in the account. The voucher entry and payment in April in effect convert the account into a prepaid expense account until the end of June at which time the cycle repeats itself.

Summary of Overhead Accumulation. A number of points need to be emphasized by way of summarizing the subject of overhead accumulation:

1. No matter from what source overhead originates it always is charged to a controlling expense account such as Manufacturing Overhead. The same holds true for marketing expense and for general administrative expense.
2. Each charge to a control account must be reflected in a primary overhead ledger, one for each of the above controls.
3. Each charge to a primary overhead account must be analyzed by departments and charged to departmental overhead accounts either in a departmental overhead ledger or an overhead distribution sheet (see next chapter).
4. All journal vouchers must be supported by original evidences or documents:
    - *a*) Indirect material by stores requisitions and resulting summary of materials issued.
    - *b*) Indirect labor by time tickets and payroll summaries or labor distributions.
    - *c*) Voucher register charges by purchase vouchers.
    - *d*) Fixed charges by journal vouchers or work sheet analyses.

QUESTIONS

1. If interest on investment is included as part of manufacturing overhead, indicate the effect on cost of production, inventories, and net profit.

2. Interest on investment is a cost involving no ultimate payment or liability and is not based on objective valuation. The financial accountant would normally exclude this item, indicating that it does not result in an accounting transaction. How does the cost accountant justify the charge for interest on investment?

3. The use of depreciation on replacement cost of fixed assets is not unlike the adoption of Lifo valuation for inventories in the effect on income and the balance sheet. Explain.

4. List four arguments for and four arguments against the use of an estimate for depreciation based upon replacement cost during a period of rising prices.

5. Manufacturing overhead is incurred to secure production. What purpose is served in setting up departmental manufacturing overhead accounts for service departments which are not directly concerned with production, thus merely adding another step to the process of assigning manufacturing overhead to products?

6. Differentiate between a capital charge and a charge to revenue.

7. Distinguish between a product charge and a period charge.

8. Who should determine the cutoff points as between manufacturing overhead and other costs—management or the accounting department?

9. Explain why, over a period of years in this country, manufacturing overhead has tended to become a proportionately larger part of the total cost of producing goods.

10. Your company is considering making application for accelerated depreciation (5-year basis) for a plant just completed at a cost of $1,500,000. The estimated life of the plant under ordinary usage is 30 years. Discuss the advisability of adopting accelerated depreciation, considering both short-run and long-run implications.

11. In an effort to increase efficiency the Eagle Manufacturing Corporation is considering supplying its employees with a wider range of tools than was the practice heretofore. Discuss the following points in connection with a report to the company on the matter of accounting for tools:
    a) Number of accounts kept for tools
    b) Distinguishing characteristics of items charged to each account
    c) Basis of differentiating between tools charged to asset accounts and those charged to overhead
    d) Control of tools in the hands of employees
    e) Procedure in distributing tool expense if not directly charged
    f) Depreciation policy on capitalized tools

12. A manufacturing concern follows the practice of charging the cost of direct materials and direct labor to work in process but charges off all indirect costs (factory overhead) directly to profit and loss. State the effects of this procedure on the concern's financial statements and comment on the acceptability of the procedure for use in preparing statements.

13. Discuss how you would obtain comparable costs of production of two separate manufacturing corporations, "X" and "Y," engaged in similar operations in an industry in which most corporations own their plants, in the following circumstances:
    "X" corporation owns its plant—land, buildings, and equipment.
    "Y" corporation occupies a similar factory which it rents.
    "X" corporation pays a yearly interest on borrowed money.
    "Y" corporation is not in debt for borrowed money.

14. Because of its large volume of business, the Hall Company is operating its plant 70 hours a week instead of the 35 hours a week which it usually operates. The company computes depreciation on a straight-line basis. Because of the increased rate of operation, the treasurer has suggested that depreciation rates should be doubled. Discuss this suggestion of the treasurer, including a full discussion of the factors that should be considered by the company in determining rates of depreciation. Do not consider income tax effects.

Chapter 12

DISTRIBUTION OF MANUFACTURING OVERHEAD

Nature of Problem. The second step in accounting for overhead is the assignment of overhead to departments. It is the purpose of this chapter to explain departmental distributions, their nature, purpose, and methodology.

In point of fact there are two types of departmental distributions. The first may be referred to as a primary distribution and consists of charging the primary expenses to departments, either directly or by some scheme of allocation. By identifying primary expenses with departments it is possible to know what it costs to operate each department. This type of distribution is in the nature of a *functional* distribution which means that, so far as possible, primary expenses are directly traced to a departmental activity.

Another type, known as a secondary expense distribution, involves the redistribution of the service department totals to the other departments which received the benefit of the services. Carried to its logical conclusion this means that all service department totals are closed out and all expenses are eventually reflected in the producing departments. The purpose of the redistribution is to ascertain the total expense, direct and indirect, of operating a department. In turn this total serves as a basis for the development of applied manufacturing overhead rates.

Bases for Primary Overhead Distributions. Ordinarily, expenses are distributed, in the absence of specific measurement, on the basis of some physical coefficient such as area, cubic content, horsepower, and kilowatt-hours. It is necessary therefore to have available a great deal of information, among which may be cited blueprints of plant layouts, plant and equipment ledgers, and insurance registers—in short, all the documentation mentioned in Chapter 11. Items such as building depreciation, building insurance, building maintenance, and even building taxes are quite commonly prorated on a floor area basis. Heat, if it is not meter-measured, may be distributed on the basis of the cubic content of the various departments, or the floor area, or the square feet of radiation. Similarly, lighting expense may be prorated on the basis of floor area, cubic content, number of outlets, or kilowatt-hours; power may be distributed on the basis of rated capacities of machines, machine hours, horsepower hours, or even direct labor hours.

Limitations of Primary Overhead Distribution. Primary overhead distributions represent an attempt to assign manufacturing overhead to particular departments either through precise measurement or through a process of estimating. Where overhead items can be directly identified with departmental operations no particular problem arises, because the allocation is determined on the basis of benefit derived and is capable of exact quantitative measurement. Thus where departmental meters are installed to measure the consumption of light or power the resulting cost allocation can be said to be exact. If, however, a single plant meter measures the over-all consumption of light and power, the proration results in estimated departmental costs for these items. All prorations are therefore estimates and as such subject to the limitations of all cost estimates. Usually no one basis of proration is free from objection, and the cost accountant is bound to effect some compromise between a theoretically perfect method and one that is suited to the practical exigencies of the local conditions. A distribution of light expense on an area basis may be perfectly satisfactory in one plant where the lighting system is uniform, and the ceiling heights do not vary. But where some departments require special lighting, such as mercury arc, fluorescent, or indirect lighting, and where different light intensities are required, or ceiling heights vary, obviously an area basis is out of the question. As nearly as possible some basis of distribution must be selected that takes into account all the factors likely to exert an influence on the behavior of the expense in question. To the extent that the cost accountant must depart from such theoretical perfection he lays himself open to the objection that all such prorations are mere guesswork. The answer is that these "guesses" represent the most careful estimates possible under the given conditions and are not to be dismissed merely because they do not represent more precisely measured data.

Below are presented some typical accounts and their allocations. It is well, however, to keep in mind the above limitations.

Building Repairs and Maintenance. Building repairs and maintenance are accounted for in one of two ways:

1. Actual expenses incurred for repairs and maintenance each month are charged to a Building Repairs and Maintenance Expense account which is prorated at the end of each month.
2. Use of a maintenance reserve.

Building repairs, particularly major repairs occurring irregularly, cause pronounced fluctuations in annual maintenance charges. It is often desirable to stabilize these charges by anticipating repairs for a fairly long term, and prorating such estimates to each cost period. This in effect converts maintenance into a fixed charge, since a maintenance account is debited whether repairs were made or omitted. The offsetting credit is to Allowance for Repairs; actual repairs are debited to this reserve. The above practice is quite common; steel mills and foundries often show an account variously called Allowance or Reserve for Relining of Furnaces which falls into this group.

Under both plans, the departmental distribution of repairs and maintenance expense is often made upon an area basis; i.e., on the area occupied by each department in the building, expressed as a percentage of total area.

Actually a distinction must be made between repairs performed by an outside concern, those performed within a department by persons on its payroll, and those performed by maintenance department personnel. Repair and maintenance work performed by an outside concern is of course represented by invoices indicating the exact nature and location of the work done. This makes it possible to charge the expense directly to the proper repair and maintenance overhead classification under the department receiving the benefit of the work. Where the repair work was done in a given department by its own personnel, time tickets serve as evidence of the work and produce the proper departmental charge when the labor distributions are made. If, however, the repair is made by repair and maintenance department crews the procedure is slightly different. In such cases the repair department may issue a work order to cover the work to be done, provided it is a sizable repair job. Such work orders are analogous to production orders in the shop. They serve as authorizations to do the work and as a means of collecting the costs of the repair work. All time tickets and material requisitions must bear the work order number to facilitate posting and make possible a computation of the total cost of the work done which is, of course, charged to the appropriate account in the department receiving the benefit of the work done.

In many instances no work orders are issued because the work is of a minor nature. For example, if a power belt breaks in Department A, the foreman of the department asks the repair department for a belt lacer. The latter department issues a time ticket to a belt lacer who reports to Department A and who, after performing the necessary repair, has his time ticket signed by the foreman of that department. Upon his return to the repair department the ticket is canceled in the usual way, and the elapsed time charged to the proper expense account in Department A when the labor distribution is made. If any material has been requisitioned it too is charged to the same expense.

A question that frequently arises is whether any overhead is to be charged on these work orders. Practice varies in this respect. In some plants it is the custom to charge repair work done with overhead of the repair department at a predetermined rate based on labor cost, labor hours, or some other convenient basis. In other plants, only jobs requiring work orders are so charged. In still others, only labor and material are charged. In the latter case, the expense of operating the repair department must be redistributed on some equitable basis. This is discussed later in the chapter in connection with secondary distributions. Even where maintenance overhead is charged there is likely to be some overapplied or underapplied expense to be redistributed later.

Building Depreciation. As explained in the previous chapter, a property ledger is used to classify plant investment by type of land, buildings and equipment, location, and value. Based on this information and the plant layout figures, it is possible to work out a distribution of building expense to the departments occupying the building or buildings on an area basis. In some cases a portion of the depreciation charge as well as of insurance and taxes is identifiable with a specific department, particularly the power department. In that event the amount relating to that department is segregated and only the balance distributed as shown above.

Insurance. Insurance consists of several types of coverage against losses from different causes. Usually this expense is charged departmentally on the basis of insurable value in each department. In the case of building insurance it may be distributed on an area basis. An illustration of insurance distribution is furnished by the Rubber Manufacturing Industry:

> Boiler explosion insurance should be applied specifically to all production departments utilizing pressure vessels as well as to power departments.
>
> Fidelity insurance will be charged to those departments whose employees are bonded under the schedule at specific cost.
>
> Payroll robbery insurance should be charged to the payroll department.
>
> Automobile insurance should be charged according to specific coverage.
>
> Tornado, use and occupancy, plant explosion, riot and civil commotion and elevator insurance cost should be collected with all other expenses to be prorated on a floor space basis and spread to all departments, excepting those in the power division, which should be charged with their prorata share before the floor space overhead distribution is made.

Taxes. Taxes on buildings are segregated from those on personal property. Some taxes may be charged specifically to departmental account. Taxes on personal property should be prorated departmentally on the basis of the taxable values in each department. In the case of inventories, the stores department may be charged for taxes on raw materials, the finished goods warehouse for tax on finished merchandise. The latter is ordinarily considered a selling expense. Where taxes on work in process are involved they may be prorated on the basis of inventory values in each department at the beginning or end of the year, or better still, on the basis of *average* inventory values. Taxes on real estate (land and buildings) may be allocated departmentally on an area basis. Frequently, this is done by charging a service department account such as Building Expense and then redistributing the latter on an area or some other basis.

Small Tools Expense. Three basically different methods are used to allocate the expense of small tools. At the time of purchase, such tools may be capitalized in a Small Tools account, or charged to Stores, or charged to some overhead account.

Under the capitalization method all purchases of small tools are capitalized in a Small Tools account which is considered a fixed asset. Depreciation is applied in order to establish annual and monthly amounts to charge off as expense. This is a difficult method to administer properly because of the variation in, and the uncertainty of, the length of life of many different small tools. Under this method, the monthly allocation of small tools expense is similar to that used for depreciation of machinery and equipment.

Another method is to charge stores for all small tool purchases. As tools are needed, they are requisitioned and charged to the proper department at the end of each month by sorting requisitions departmentally.

Finally, small tool purchases may be charged to expense at the time of purchase. This method is common because of its simplicity. Analysis is made of all purchase vouchers which indicate a charge to the account for Small Tools, in order to allocate charges to the several departments. Analysis may be made from day to day or at the end of the month.

Patterns, Tools, and Dies. Where patterns, special tools, or dies are made for a special job, the entire cost is chargeable to the job. Where patterns, tools, and dies are made for changes in a model to extend over a period of a year, the charges are amortized on different bases. A common method is to charge the expense on the basis of actual or estimated production in those departments where the dies are used. This expense therefore becomes a direct charge to production.

Mechanics of Computing Departmental Distributions. The most common procedure where a functional distribution is indicated is to express each department's share as a percentage of the total base and then multiply the resulting percentages by the figure to be distributed. An example of this method appears below:

A rent bill of $1,000 is to be distributed departmentally on an area basis. The areas in question and the results are shown in the following tabulation:

Department	Area in Sq. Ft.	Per Cent of Total Area	Prorated Amount
A	2,000	16%	$ 160.00
B	3,000	24	240.00
C	3,500	28	280.00
D	2,500	20	200.00
E	1,500	12	120.00
	12,500	100%	$1,000.00

The above method distributes the total rent charge, but it involves the calculation of five percentages and the carrying out of five multiplications, a total of ten computations. In practice the figures would not be as simple as those above and would therefore be much more burdensome. In addition there may be fifty primary accounts in a department and perhaps forty to fifty departments. All of which adds up to several thousand computations. Two things can be done to lighten the burden:

1. Use of unit cost rates to make the distributions
2. Combining a number of items to be distributed *on the same basis* into a single group

UNIT COST RATES. Under this method a unit cost is obtained and each department charged for its share of the total on the basis of the selected factor of variability. Reverting once more to the example used above, the distribution appears as follows:

Department	Area in Sq. Ft.	Unit Cost	Prorated Amount
A	2,000	$.08	$ 160.00
B	3,000	"	240.00
C	3,500	"	280.00
D	2,500	"	200.00
E	1,500	"	120.00
	12,500		$1,000.00
Total rent charge			$1,000.00
Cost per square foot ($1,000 ÷ 12,500)			$ .08

Under this method a cost per square foot is first obtained and this unit cost is then multiplied by the areas in the respective departments to determine the charge to each. This involves a total of only six computations, one division for the unit cost, and five multiplications. It is obvious that the more departments there are, the greater the saving in time and effort to effect the distribution.

The same principle holds in those cases where the distribution is based on value rather than on some other measurement. In these cases a percentage relation is involved. For example, if stores handling costs of $3,000 are to be prorated on the basis of dollar value of stores requisitions processed, the resulting calculation would appear as follows:

Department	Value of Requisitions	Percentage of Requisition Value	Prorated Amount
A	$3,000.00	25%	$ 750.00
B	2,000.00	"	500.00
C	4,000.00	"	1,000.00
D	2,500.00	"	625.00
E	500.00	"	125.00
	$12,000.00		$3,000.00
Total stores expense			$3,000.00
Percentage relation ($3,000 ÷ $12,000)			25%

After the percentage relation is established, the figures in the last column are derived by applying the percentage to the value of requisitions in each department.

Grouping of items. Another type of short cut is frequently possible. This consists of taking a number of expense items, lumping them together, and making a single distribution of the entire group. An example follows.

It is required to distribute rent, light, and heat on an area basis. The charges to be distributed are respectively $1,000, $400, and $800, a total of $2,200. The distribution, on a unit cost basis, appears as follows:

Department	Area in Sq. Ft.	Prorated Amount
A	2,000	$ 352.00
B	3,000	528.00
C	3,500	616.00
D	2,500	440.00
E	1,500	264.00
	12,500	$2,200.00
Total charges		$2,200.00
Cost per square foot		$ .176

Where this method is to be used it is advisable to group the primary expenses according to the factor of variability which is to be used as a basis for the distribution. In this way all accounts to be distributed on the same basis are immediately available as a unit and can be processed together.

Departmental Overhead Records. A convenient way to collect departmental overhead is through the use of a specially designed ledger. Each page represents one department. The subaccounts appear across the page as columnar headings and present a running analysis during the month of the expenses incurred in each department. If desired, a duplicate at the end of the month may serve as the foreman's copy of the report of the month's activity. The totals for each department by subaccounts are then carried to the overhead distribution sheet.

The overhead distribution sheet (Figure 67) presents at a glance all expenses of all departments. The departmental overhead ledger may feed into it, or the distribution sheet may receive postings directly from original sources. In any event, it is an excellent summary in compact form of the departmental distributions. The top portion presents various statistical data to be used in making departmental distributions. These are followed by the primary overhead accounts which should be arranged in the left-hand margin in exactly the same order as they are arranged in the subsidiary overhead ledger. In this way, the transfer of account balances to the distribution sheet is greatly facilitated at the end of each month. The bottom portion shows the service department distributions to be explained presently.

After the subsidiary overhead ledger balances are proved with their control account at the end of each month, the balances are transferred to the grand total column of the expense distribution sheet. Next, the grand total column is added and proved again with the control account balance. The totals of each account are then distributed among the departmental columns. This constitutes the primary overhead distribution.

Secondary Departmental Distributions. Secondary distributions are necessary in order to enable the cost accountant to determine the total cost of operating a department, and, more importantly, to build proper overhead rates which in turn are used to charge the product. Since the product travels only through the producing departments it must absorb *all* the manufacturing overhead, both of producing and service departments, during its travels through the producing departments. This means that the rates in each of the producing departments must be set high enough to assure complete absorption of manufacturing overhead under normal conditions. This matter is more fully dealt with in the next chapter.

It should be emphasized at this point that it is not actually necessary to redistribute the service department charges in the books of account. The total manufacturing overhead remains the same as before the redistribution took place; all that happens is a reshuffling of service department charges. Hence it should be borne in mind that the procedures

	Basis of Distribution	Total	Producing Departments					Marketing and General Administration	Stores	Machine Shop	Busheling	Shipping	Inspection and Packing
			Cutting Room	Trimming Dept.	Coat Shop	Pants Shop	Bullion Dept.						
Floor Space		33,060 ft.	5,700 ft	1,540 ft.	3,580 ft.	3,000 ft.	1,000 ft	5,150 ft.	3,990 ft.	300 ft.	400 ft.	2,800 ft.	600 ft.
Value of Machinery		$10,000.00	$ 100.00		$6,000.00	$3,000.00	$100.00			$500.00	$100 00	$200 00	
Number of Workmen		243	22	4	120	75	7		2	1	5	3	4
Number of Connected Horsepower		30	3		10	11				3	1	2	
Number of Electric Lamps		100	15	5	30	20	4	10	4	2	2	4	4
Amount of Production			9,200	9,200	6,000	3,200	2,000						
Expenses													
Supervision	Number of Workmen	$ 2,000.00	$ 180.00	$ 32.00	$ 996 00	$ 616 00	$ 56.00		$ 16.00	$ 8.00	$ 40.00	$ 24.00	$ 32.00
Foremen	Actual	1,500.00	200.00	200.00	400.00	400.00	180.00				120.00		
Indirect Labor—Maintenance	Floor Space	500.00	86.00	23.00	128 50	45.50	16.00	$ 77.50	60.50	5.00	6.00	42 00	10.00
Depreciation, Machinery	Value of Machinery	300 00	3.00		180.00	90.00	3 00			15 00	3.00	6.00	
Taxes, Machinery	Value of Machinery	300 00	3.00		180.00	90.00	3 00			15 00	3.00	6.00	
Rent	Floor Space	2,000.00	344.00	92.00	514 00	182 00	64.00	310.00	242.00	20.00	24.00	168.00	40.00
Insurance, Machinery	Value of Machinery	200.00	2.00		120 00	60.00	2 00			10.00	2.00	4.00	
Liability Insurance	Number of Workers	100 00	9.00	1 60	49 80	30 80	2.80		.80	.40	2.00	1.20	1.60
Repairs, Labor, and Material	Actual	250.00	25.00	5 00	70 00	50 00	15.00	30 00		25 00	30.00		
Stationery and Printing	Arbitrary	400.00	30 00	20.00	70 00	70.00	45 00	30 00	50.00	5.00	5 00	50.00	25.00
Miscellaneous Factory Expenses	Arbitrary	175 00	10.00	12.00	30.00	30 00	25 00		20.00	5.00	3 00	25.00	15.00
Heat	Floor Space	400 00	68 80	18 40	102 80	36 40	12 80	62 00	48.40	4.00	4 80	33.60	8.00
Power	Number of Connected Horsepower	300 00	30 00		100 00	110 00				30 00	10.00	20.00	
Light	Number of Bulbs	200 00	30 00	10 00	60 00	40 00	8 00	20.00	8.00	4 00	4.00	8.00	8.00
Total Primary Expenses		$ 8,625 00	$1,020.80	$414.00	$3,001.10	$1,850.70	$432.60	$529.50	$445 70	$146 40	$256.80	$387 80	$139.60
Redistributed Service Department Expenses													
Stores	Units of Material Requisitioned		75.00	50 00	175.00	100 00	20 00		$445 70*		25 70		
Machine Shop	Value of Machinery		1.46		92.25	46.85	1.46			$146.40*	1.46	2.92	
Busheling Department	Amount of Production		113 58	28 40	85 19	56.79					$283.96*		
Shipping Department	Floor Space		113 31	31 26	168.00	58.61	7.82					$390.72*	11.72
Inspection and Packing	Amount of Production		52 97	15.13	45 40	30 26	7.56						$151.32*
Total Actual Expenses		$ 8,625 00	$1,377 12	$538 79	$3,566 94	$2,143.21	$469 44	$529 50					

FIGURE 67. Manufacturing Overhead Distribution Sheet

explained below take place, for the most part, on the overhead distribution sheet as memorandum distributions. If desired, these secondary distributions may of course be reflected in the departmental accounts.

---

* In red.

In making the computations, the same short cuts should be used as in the case of the primary expense distributions. The unit cost method is, in fact, the most logical basis. Aside from the saving in mathematical effort there is a distinct advantage in the unit cost method. The unit cost in itself has a meaning for the cost accountant, since, by comparison with previous periods or against a standard, it gives him a clue as to the efficiency of a department. The bottom portion of Figure 67 illustrates the mechanics of service department distributions.

Bases for Distributing Service Department Overhead. The remarks made concerning the limitations of primary expense distributions hold, with added force, for secondary distributions. In short, service distributions depend almost entirely on the selection of a proper basis. Many bases are available; what is proper in a given instance involves consideration of a number of factors such as the nature and amount of service rendered by the specific department and the number of departments receiving such service. However, it must be emphasized at the outset that a use basis is not necessarily a good measure for distribution. Suppose, for example, that a first aid station is being maintained to take care of casualties in the plant. How should the expense of operating this department be distributed? On the *number* of accidents occurring in each department? On the seriousness of the accidents? If so, what criteria of measuring the seriousness of accidents are available? Suppose further, there are *no* accidents in a given month. What is to be done then?

The above questions suggest two general principles for the distribution of service department expenses:

1. Distribution on the basis of service received
2. Distribution on the basis of readiness to serve

The first method represents a strict use basis. All that is necessary is to find a suitable factor that, in the opinion of the cost accountant and others concerned, represents a fair basis of measuring the service. The second method presents a more difficult problem. In practice it is often combined with the first method. In such cases "readiness to serve" is represented by a minimum charge and to it is added a charge based on benefit derived.

More specifically, some of the bases used in effecting secondary distributions are in the form of meter readings or engineers' estimates; number of employees, number of time tickets handled, labor hours, labor dollars; area, cubic content, weight; number of material requisitions, value of requisitions; property values; machine hours, crane hours, and truck hours.

Chain of Distributions. A given department may serve several producing departments as well as other service departments. In such cases, the prorations are cumulative in the sense that each successive distribution represents a total made up of primary departmental charges and secondary charges from other service departments. For example, the repair department overhead may be allocated in part to building overhead. The latter in turn is distributed in part to the cost accounting department, from where a final distribution may be made to producing departments.

When service department distributions are made to other service departments, the arrangement of service department columns on the overhead distribution sheet must be carefully planned. Those service departments which provide the greatest number of distributions to other service departments should be distributed first. In passing from left to right on the work sheet, each service department has at least one less distribution than the column on its left; that is, expense distributions are made in column order from left to right in stepping stone fashion. As soon as each distribution is computed, it is posted to the overhead distribution sheet, thus closing out a specific departmental column. The next column immediately to the right is then totaled and this total is used in making a distribution to any or all departmental columns to the right. When all service departments have been thus distributed, the producing department columns are totaled.

One of the most interesting secondary distributions is that connected with the powerhouse. Here different forms of energy are produced, each serving a number of uses and requiring different prorations. Figure 68 shows roughly the flow of power department costs. The first step is to collect the primary charges of the powerhouse independently of the remainder of the plant, as though the power division were a separate institution. Within the power department, the expenses are analyzed and either charged directly to the boiler room and engine room, where possible, or else allocated to these two cost centers on some equitable basis.

In the boiler room the number of thousands of pounds of steam produced during the month is determined from meter readings; these meters measure the flow of steam to the building heating lines and to steam power turbines. Readings of all meters are taken at the beginning and end of each month. The total overhead for the month incurred in steam production is divided by the number of thousands of pounds of steam produced, which gives a unit cost per thousand pounds of steam. The steam consumption of building heat lines and turbines is then multiplied by the unit cost to determine the steam cost for the various purposes served by the power plant.

The cost department is given a copy of the monthly steam meter readings. From it the cost of producing 1,000 lbs. of steam is calculated, making possible the proration of the steam cost as indicated in Figure 68. Some of the steam may be used as process steam, as for instance steam used in blocking felt hats or in producing compressed air.

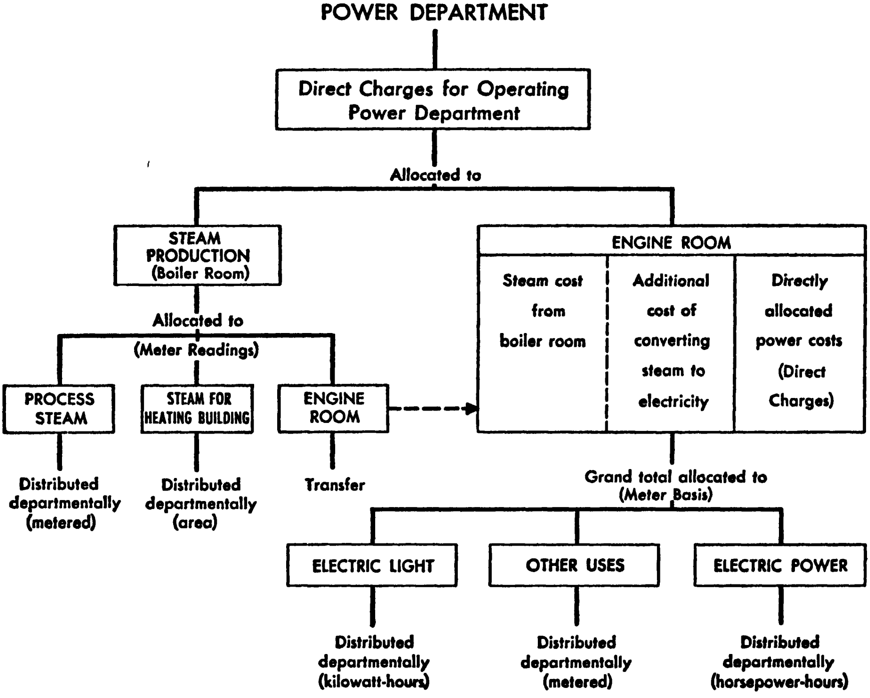

POWER DEPARTMENT
Direct Charges for Operating Power Department
Allocated to
STEAM PRODUCTION (Boiler Room)
Allocated to (Meter Readings)
PROCESS STEAM
STEAM FOR HEATING BUILDING
ENGINE ROOM
Distributed departmentally (metered)
Distributed departmentally (area)
Transfer
ENGINE ROOM
Steam cost from boiler room
Additional cost of converting steam to electricity
Directly allocated power costs (Direct Charges)
Grand total allocated to (Meter Basis)
ELECTRIC LIGHT
OTHER USES
ELECTRIC POWER
Distributed departmentally (kilowatt-hours)
Distributed departmentally (metered)
Distributed departmentally (horsepower-hours)

FIGURE 68. Flow of Power Costs Illustrated

It may also be used for heating one or more buildings, the balance of steam being turned into the engine room for conversion to electrical energy. The chart indicates the distribution for these three uses on the basis of meter readings. In the case of process and heating steam final distributions are then made to other departmental accounts on a use basis as shown in the chart. In the engine room the total cost of producing electricity is made up of the transferred steam cost from the boiler room to the engine room plus the added cost of converting that steam to electricity plus the first allocation of power costs. This grand total is then distributed as between electricity used for lighting, for power, and for other uses such as testing purposes in the laboratory. Finally each of these is distributed departmentally as shown by the chart.

Reciprocal Distributions. It often happens that services rendered by certain service departments are, in part, utilized by certain other service departments. Hence, where two or more service departments render services to each other, a vicious circle is created in ascertaining the amounts to be distributed to each other. The term "vicious circle" is applied to this type of problem, because where two departments, A and B, are interdependent, it is impossible to know the total overhead of A until the distribution of B is complete, but B's distribution cannot be made until it has received its share of A's overhead.

When service department overhead distributions are made to other service departments on a reciprocal basis, no particular arrangement of service department columns need be provided on the overhead distribution sheet. Those departments not included in the vicious circle are distributed first; other departmental overhead is then computed from work sheets or other devices.

In each of the interdependent departments the distribution base is reduced to a percentage of the total. For example where man-hours are used as a basis for distribution, such man-hours are expressed as a percentage of total man-hours.

The following problem illustrates the method involved in reciprocal distributions:

Primary Overhead Charges		
1. Producing Departments		
Machine Shop	$29,167.67	
Finishing	8,859.80	
Heat-Treating	7,744.70	
Assembly	5,039.54	$50,811.71
2. Service Departments		
Engineering	$ 3,300.00	
Toolroom	3,700.00	
Storeroom	3,800.00	
Factory Accounting	2,100.00	
General Plant	2,200.00	
Power	12,000.00	27,100.00
Total Manufacturing Overhead		$77,911.71

The distributions for the service departments, expressed in percentage form, are shown in Figure 69. Obviously, the engineering department and toolroom are not part of the vicious circle.

	Machine Shop	Finishing	Heat-Treating	Assembly	Engi-neering	Toolroom	Storeroom	Factory Account-ing	General Plant	Power
Storeroom	59.3%	10.3%	6.3%	23.4%		.4%	–			.3%
Factory Accounting .	27.0	33.2	7.7	18.9	2.3%	2.0	4 1%	–	1.6%	3.2
General Plant Service .	26.9	33.0	7.7	18.8	2.3	1.9	4.1	2.0%	–	3.3
Power	66.5	10.1	10.9	4.3	1.5	3.7	2.1	.6	.3	–
Engineering .	50 0	25.0	10.0	15.0	–					
Toolroom	28.0	42.0	8.0	22.0		–				

FIGURE 69. Summary of Percentage Distribution of Service Departments

Methods for Solving Reciprocal Distributions. Several methods are available for solving vicious circle problems. Of these only two merit immediate attention:

1. Method of continued distribution
2. Method of simultaneous equations

METHOD OF CONTINUED DISTRIBUTION. This method consists of closing and reopening the departmental service accounts by successive distributions. The steps involved are as follows:

1. Apply the given percentage to prorate the primary total in the first service department. This closes the account and charges the prorated amounts to other departments.
2. Apply the given percentages to the second service department whose total is made up of primary accounts, plus proration from service department No. 1. This closes the second department and charges the others including, perhaps, No. 1.
3. Apply the same procedure to all other service departments.
4. Repeat a second cycle of operations beginning with department No. 1, whose total consists at present only of amounts prorated from other service departments. In this way the service department totals become less and less with each cycle of distributions.
5. Stop the process at any point where it is felt the resulting figures are too small to be of any consequence.

The entire procedure is illustrated in Figure 70. The vertical totals (Figure 70, columns 7 to 11) represent amounts charged to all producing departments from the various service departments. The total of these columns is $27,100, showing that all service department overhead is accounted for.

To arrive at the total debits in the service department accounts after all redistributions have been made, simply add the various subtotals in each of the first four columns of Figure 70:

	Storeroom	Factory Accounting	General Plant Service	Power
Total from Cycle I	$3,800.00	$2,100.00	$2,233.60	$12,152.31
Total from Cycle II .	432.88	117.58	38.34	6.33
Total from Cycle III . .	6.52	.81	.03	.05
Total from Cycle IV . . .	.03			
Final totals	$4,239.43	$2,218.39	$2,271.97	$12,158.69

These totals, together with those for engineering and toolroom services, are then distributed to producing and other service departments in accordance with the percentages indicated in Figure 69. The results are shown in Figure 71, which represents the lower portion of a completed overhead distribution sheet.

Cycle		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
								Charged to Producing Departments From				
		Storeroom	Factory Accounting	General Plant Service	Power	Engineering	Toolroom	Storeroom	Factory Accounting	General Plant Service	Power	Engineering & Toolroom
I	Storeroom	$3,800 00			$ 11.40		$ 15.20	$3,773.40				
	Factory Accounting ..	$ 86 10	$2,100 00	$ 33.60	67.20	$ 48.30	42.00		$1,822.80			
	General Plant Service			2,200 00								
	Total Distribution	91 58	$ 44.67	$2,233.60	73.71	51.37	42.44			$1,929.83		
	Powerhouse Expense				12,000 00							
	Total Distribution	255 20	72.91	$ 36.46	$12,152.31	182.28	449.64				$11,155.82	
II	Storeroom .. .	$ 432 88			$ 1.30		1.73	429.85				
	Factory Accounting	$ 4.82	$ 117.58	1.88	3.76	2.70	2.35		102 07			
	General Plant Service	1.57	$ .77	$ 38.34	1.27	.88	.73			33.12		
	Powerhouse Expense	.13	.04	.02	$ 6.33	.10	.23				5.81	
III	Storeroom	$ 6 52			$ .02		.03	6.47				
	Factory Accounting	$ .03	$ .81	.01	.03	.02	.02		.70			
	General Plant Service			$ .03						.03		
	Powerhouse Expense				$ 05						.05	
IV	Storeroom .	$ .03						.03				
	Engineering (primary exp.)					3,300.00						
	Total Distribution					$3,585.65						$3,585.65
	Toolroom (primary exp.)						3,700 00					
	Total Distribution						$4,254 37					4,254.37
	Total Charges to Producing Departments							$4,209.75	$1,925.57	$1,962 98	$11,161.68	$7,840.02

FIGURE 70. Work Sheet for Continued Distribution of Service Department Charges

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
		Producing Departments				Service Departments					
	Grand Total	Machine Shop	Finishing	Heat-Treating	Assembly	Engineering	Toolroom	Storeroom	Factory Accounts	General Plant	Power
Total Primary Charges	$77,911.71	$29,167.67	$ 8,859.80	$ 7,744.70	$5,039 54	$3,300 00	$3,700 00	$3,800.00	$2,100.00	$2,200.00	$12,000.00
Service Department Distributions:											
Storeroom		2,513.98	436.66	267.08	992 03		16.96	4,239.43*			12 72
Factory Accounting		598.96	736.51	170 82	419 28	51 02	44 37	90.95	2,218.39*	35.49	70 99
General Plant Expense .		611.16	749.75	174.94	427 13	52.25	43.17	93 15	45.44	2,271.97*	74.98
Powerhouse Expense		8,085.53	1,228.03	1,325 30	522.82	182.38	449.87	255 33	72.95	36.48	12,158.69*
Engineering		1,792 83	896.41	358.57	537 84	3,585 65*					
Toolroom .		1,191.22	1,786.84	340.35	935.96		4,254 37*				
Total Expenses	$77,911.71	$43,961.35	$14,694.00	$10,381.76	$8,874 60	-0-	-0-	-0-	-0-	-0-	-0-

* In red.

FIGURE 71. Secondary Distributions of Service Departments on Reciprocal Basis

METHOD OF SIMULTANEOUS EQUATIONS. From the overhead distribution table (Figure 69), a series of simultaneous equations can be formulated as follows:

(1) Let a = Storeroom overhead including allocations from other departments
(2) Let b = Corresponding factory accounting office overhead
(3) Let c = Corresponding general plant office overhead
(4) Let d = Corresponding powerhouse overhead
(5) Then $a = \$\ 3{,}800 + .041b + .041c + .021d$
(6) $b = 2{,}100 + .020c + .006d$
(7) $c = 2{,}200 + .016b + .003d$
(8) $d = 12{,}000 + .003a + .032b + .033c$

Transposing:

(9) $a - .041b - .041c - .021d = \$\ 3{,}800$
(10) $b - .020c - .006d = 2{,}100$
(11) $-.016b + c - .003d = 2{,}200$
(12) $-.003a - .032b - .033c + d = 12{,}000$

By combining equations and eliminating unknowns, the following results are obtained:

$a = \$4{,}239.44$
$b = 2{,}218.39$
$c = \$\ 2{,}271.97$
$d = 12{,}158.69$

These values are identical to those obtained by the other method. However, solution by simultaneous equations is not as practicable as other methods. This is especially true where there are more than three reciprocal transfers of interdepartmental service expenses.

QUESTIONS

1. Is there an effect on net profit when a faulty distribution of manufacturing overhead has been made? Explain.
2. Discuss three methods of handling small tool expense as an element of manufacturing overhead.
3. The distribution of service department overhead to producing departments involves problems not unlike those encountered in determining fair bases for distributing the cost of government upon its citizens. Discuss the suitability of the following principles with regard to service department distribution:
   a) Ability to pay
   b) Benefits derived
   c) Readiness to serve

4. What sequence should be followed in distributing service department overhead to producing departments?
5. What is meant by reciprocal distributions?
6. What bases would you use for distributing the following service departments:
    - *a*) Powerhouse
    - *b*) Maintenance
    - *c*) Testing laboratory
    - *d*) Employment
    - *e*) Purchasing
    - *f*) Storeroom
    - *g*) Timekeeping
    - *h*) Payroll
    - *i*) Toolroom
    - *j*) Dispensary
    - *k*) Cafeteria
    - *l*) Internal transportation
    - *m*) Cost accounting
    - *n*) Receiving and inspection
    - *o*) Production control
7. What purposes are served by making manufacturing overhead distributions?
8. List the advantages and disadvantages of the nonreciprocal method of distribution of service department overhead to producing departments.
9. Should service department allocations be included in monthly reports to foremen? Why or why not?
10. Is any purpose served in journalizing service department distributions?
11. Assume you are the head storeskeeper. You have just received the monthly operating report showing the *total* cost of operating your department amounting to $5,500, including service department allocations. The month before, the report showed a total of $5,200. However, some changes had been made in the interim in the method of distributing various services. At a conference of department heads, you are asked to explain or defend the $5,500 total.

    Indicate what line your explanation might take.

Chapter 13

APPLICATION OF MANUFACTURING OVERHEAD

Nature of Problem. In previous chapters, consideration was given to the accumulation and distribution of manufacturing overhead. The aim was the determination of the manufacturing overhead incurred in operating the producing departments of a business including the proper share of service department overhead. It is to be noted that such accumulation and distribution are concerned primarily with departmental activities. But since one of the aims of cost accounting is to attach costs to the product, some way must be found to identify manufacturing overhead with product costs. Direct material and direct labor costs, either in total or per unit of product, are readily obtainable through such devices as stores requisitions, bills of material, and time reports. But it is obviously impractical to try to determine exactly how much depreciation, insurance, taxes, and supervision are incurred on each of five hundred different jobs worked on during the course of a month. It is the purpose of this chapter, therefore, to explain the methods by which manufacturing overhead is charged to production.

Overhead may be applied to the product on the basis of rates established either before or after the expenditures are actually ascertained. These may be referred to, respectively, as predetermined and actual or historical rates. When actual overhead is used, the costing procedure cannot be completed until the close of the period. Often, this delay is disadvantageous, since final costs on completed work cannot be determined for some time after the order is finished, and, in general, the work of the accounting department is delayed. When overhead to be applied to production is properly estimated in advance, product costs may be determined immediately on completion. On the other hand, at the close of period there is a difference between the actual amount of overhead and the amount of overhead absorbed or applied to the product. This difference is called *under- or overabsorbed overhead.*

Setting Manufacturing Overhead Rates. Figure 72 shows graphically the classification of methods of overhead application and their relation to each other. The first column lists the fundamental types or bases upon which rates may be established. Each of these is further subdivided as shown in the second column of the diagram. The third column lists the specific methods of overhead application. Of these the first seven may be used in conjunction with any of the subdivisions in column two. The last one, the machine hour rate, is used only in connection with cost centers or specific machines. It must be remembered that the specific methods in the last column of Figure 72 represent only a few of the more common ones. But even so there are many methods available, all of which may give divergent results.

In general, any overhead rate represents a ratio obtained by dividing the manufacturing overhead by some activity factor or base. Thus the basic assumption is that overhead varies in proportion to the base. For example, if an overhead rate is expressed in terms of a cost per labor hour, the overhead chargeable to the product is assumed to vary with the number of labor hours. Doubling the hours doubles the cost. Whether this is a correct relationship depends on numerous factors surrounding individual cases.

In any event the process of attaching overhead to the product involves two steps:

1. Setting an overhead rate
2. Applying the rate to the product

Bases for Establishing Rates	Subdivisions for Rate Determination	Methods for Applying Rates to Products
I. Actual Costs (historical) II. Predetermined	Blanket Departmental Cost Center	1. Percentage of direct labor dollar 2. Rate per direct labor hour 3. Amount per unit of product 4. Percentage of direct material cost 5. Percentage of prime cost 6. Percentages based on market values 7. Supplementary rates 8. Rate per machine hour

FIGURE 72. Chart Showing Methods of Overhead Application

If historical overhead rates are to be used, the information regarding manufacturing overhead is most readily obtained from factory overhead ledgers or overhead distribution sheets. It does not matter whether blanket or departmental rates are to be established; the information for both is there. The second element in the rate is the activity factor which may be obtained from various sources depending on the nature of the factor. Thus, if the rate is related to production, the plant or departmental production reports would constitute the logical source of information. If labor cost or labor hours are used as the base, the labor distribution or payroll summary is the source document. Thus for each base there must be a definite source of information.

If predetermined rates are to be used in applying overhead, it is necessary to estimate the base and the amount of overhead in advance. In such cases appropriate budgets representing a combination of past experience and future expectation supply the requisite data. The information may be presented in the form of an overhead distribution sheet using forecasted in place of actual figures.

Methods Used to Apply Manufacturing Overhead. The more common methods used in applying overhead to the product are shown in the last column of Figure 72. It must be understood, however, that, except where blanket rates are used, it is not necessary that the same method be used throughout a plant. Different methods may be used in different departments of a plant depending on the nature of the manufacturing process carried on in the department.

Percentage of Direct Labor Cost. Applying overhead as a percentage of direct labor dollars is one of the oldest methods. It is certainly far and away the most common. The percentage of direct labor cost is derived by dividing the total manufacturing overhead of a producing department by the direct labor cost of this department and multiplying by 100 to convert to a percentage:

$$\frac{\text{Manufacturing overhead}}{\text{Direct labor cost}} \times 100 = \text{Percentage of direct labor cost}$$

The items for this formula may be historical or predetermined; they may be in the form of blanket, departmental, or cost center rates. Accordingly, if the manufacturing overhead in Producing Department A for the month of June is $15,000 and the direct labor cost is $10,000, a rate of 150% results. In other words for each dollar of direct labor there is to be added $1.50 of overhead. If job number 426 incurred $90 of direct labor while being processed in Department A, manufacturing overhead in the amount of $135 (i.e., $90 × 150%) is applied to this order in arriving at the cost to manufacture.

The direct labor cost method is easy to use and economical since all requisite data are available without extensive record keeping. Some shortcomings of this method include the following:

1. It ignores the contribution of value to the product by factors of production other than direct labor, e.g., machinery. In some depart-

ments it is not labor but expensive machinery that represents the prime production factor.

2. It assumes that manufacturing overhead varies with labor cost whereas many expenses such as property taxes, insurance, and depreciation, are functions of time.
3. It charges operations performed by high-rate operators with proportionately more overhead than those operations performed by low-rate operators. This results in faulty distribution of overhead to product where two or more operators in a specific department perform the same operation on different jobs or classes of product, but are paid varying rates per hour.

Rate per Direct Labor Hour. This method overcomes some of the objections urged against the labor cost basis arising from differences in labor rates. Instead, manufacturing overhead is applied here on the basis of hours of direct labor employed. The rate is determined as follows:

$$\frac{\text{Manufacturing overhead}}{\text{Direct labor hours}} = \text{Rate per direct labor hour}$$

The items for this formula may be historical or predetermined; they may also be in the form of blanket, departmental, or cost center rates. Thus, if the manufacturing overhead of Producing Department A for June is $15,000 and the number of direct labor hours in that department is 5,000, a rate of $3.00 per hour results. If Job 426 in passing through Department A incurred 42 hours of direct labor, manufacturing overhead in the amount of $126 (i.e., 42 hours × $3) is applied to this order.

Apart from the simplicity of this method is the fact that so much of manufacturing overhead is incurred with the passage of time. The rate per direct labor hour is based on time and therefore overcomes the objection raised in considering the direct labor cost method. However, the direct labor hour method like the labor cost method, ignores the contribution of value to the product by factors other than direct labor.

Rate per Unit of Product. Application of overhead on the basis of the number of units of product manufactured during the period is the simplest and most direct method for costing overhead. The overhead rate is obtained by dividing the amount of overhead by the units of product. Expressed as a formula, it is:

$$\frac{\text{Manufacturing overhead}}{\text{Number of units of product}} = \text{Overhead cost per unit}$$

As in previous cases, the terms of the expression may be actual or predetermined; also, they may be for the factory as a whole, by departments, or by cost centers. For example, if actual overhead expense for an assembly department amounts to $2,580, while the number of assemblies completed totaled 500, then the overhead cost per unit is $5.16 (that is, $2,580 ÷ 500).

The shoe industry affords an example of the application of overhead by the unit of product method (overhead per pair of shoes), in this case including commercial overhead (Figure 73).

OVERHEAD BUDGET

For Year Ending ...

	Basis—Estimated Output 800 pairs per day and 50 weeks of 5 days or 250 days = 200,000 pairs per year. Total yearly sales at $2.00 = $400,000.00	Total Yearly Budget
L 1	Supervision	$
L 2	Nonproductive Labor	
L 3	Light, Heat, Power and Water	
L 4	Rent	
L 5	Freight and Express In	
L 6	Repairs	
L 7	Supplies and Expense	
L 8	Rentals and Royalties	
L 9	Cripples	
L10	Findings	
L11	Sundry Materials	
L12	Insurance	
L13	Taxes	
L14	Depreciation	
	Total Factory Overhead	$37,670.00
M 1	Executive Salaries	$
M 2	Office Salaries	
M 3	Telephone, Telegraph and Postage	
M 4	Office Stationery, Supplies and Expense	
M 5	Legal and Accounting	
M 6	Salesmen's Salaries	
M 7	Traveling Expense	
M 8	New York Office Expense	
M 9	Freight and Express Out	
M10	Advertising	
M11	Credits and Collections	
M12	Bad Debts	
M13	Samples	
M14	General Administrative and Selling Expense	
	Total Commercial Overhead	$19,766.00
	Total Overhead	$57,436.00
	Number of Pairs of Shoes	200,000
	Overhead per Pair	$ .287
	Overhead Rate to Use	$ .30

FIGURE 73. Determination of Overhead Cost per Unit of Product

The usefulness of the method is limited to those situations where but one product, or a few closely related products possessing a common denominator, such as weight, are manufactured.

Allied to the above method is the application of overhead on a weight basis or point basis. For example, product units may be expressed as pounds, tons, 100's or 1,000's, gallons, feet, barrels, or "per each" unit. Weight as a basis is especially useful where processing is uniform but the product is packaged in several sizes, differentiated by weight in each container. This situation prevails in drugs and cosmetics. Where weight or volume does not provide a common denominator, there is the possibility of using a point base, derived by assigning a statistical point value to each product made.

The application of the weight basis may be illustrated as follows:

	Weight per Unit	Number of Units Produced	Total Weight
Product A	100 lbs.	600	60,000 lbs.
Product B	150 lbs.	300	45,000 lbs.
Product C	170 lbs.	250	42,500 lbs.
Product D	210 lbs.	400	84,000 lbs.
			231,500 lbs.

Assume total manufacturing overhead for the period in the amount of $6,945. The rate per pound is three cents ($6,945 ÷ 231,500). The manufacturing overhead to be applied to the different products produced would be:

	Total Pounds		Rate		Manufacturing Overhead Applied
Product A	60,000 lbs.	×	$.03	=	$1,800.00
Product B	45,000 lbs.	×	.03	=	1,350.00
Product C	42,500 lbs.	×	.03	=	1,275.00
Product D	84,000 lbs.	×	.03	=	2,520.00
					$6,945.00

The application of the point basis is similar to the above and works out as follows:

	Units Produced	Points per Unit	Total Points
Product A	2,000	5	10,000
Product B	2,000	10	20,000
Product C	1,500	20	30,000
Product D	1,600	25	40,000
Total	7,100		100,000

The manufacturing overhead for the month is assumed to be $5,000 yielding a manufacturing overhead rate of five cents a point ($5,000 ÷ 100,000 points).

The application of the manufacturing overhead to the individual product follows:

	Total Points		Rate		Manufacturing Overhead Applied
Product A	10,000	×	$.05	=	$ 500.00
Product B	20,000	×	.05	=	1,000.00
Product C	30,000	×	.05	=	1,500.00
Product D	40,000	×	.05	=	2,000.00
Total	100,000				$5,000.00

Percentage of Direct Material Cost. To arrive at the rate under this method the manufacturing overhead for the department is divided by the total cost of direct materials to be consumed.

$$\frac{\text{Manufacturing overhead}}{\text{Direct material cost}} \times 100 = \text{Percentage of direct material cost}$$

The expression may be in terms of actual or predetermined overhead. It could be used on a departmental, or on a blanket basis. It does not, however, have wide usefulness but does find application in special situations, notably in connection with the use of material overhead rates to establish the total cost of stores purchased (see Chapter 7).

Assuming manufacturing overhead in Department A to be $15,000 and the direct material cost $25,000, a rate of 60% results. Thus on Job 426 with a material cost of $150 in Department A, the cost applied to the product is $150 × 60%, or $90.

The percentage of direct material cost method gives reasonably accurate results where grades and prices of raw materials do not differ widely, and where quantity and cost of material in each product are uniform, and where processing is uniform. Its disadvantages, however, are significant.

1. There is no logical relationship between manufacturing overhead and the cost of raw material used.
2. As in the direct labor cost method, the time factor is entirely lacking.
3. Where prices of items of raw material differ widely, the products made from the items of high price may be weighted with more than their share of overhead.

Percentage of Prime Cost. Overhead may be applied to the product by using prime cost (direct labor and direct material) as a base. The formula is as follows:

$$\frac{\text{Manufacturing overhead}}{\text{Direct labor cost} + \text{Direct material cost}} \times 100 = \text{Percentage of prime cost}$$

Again, referring to Job 426, assume manufacturing overhead in Department A is to be applied on a percentage of prime cost. Since labor cost amounts to $10,000 and material to $25,000, the rate to be used is 42.86% (i.e., $15,000 ÷ $35,000). Since this job incurred $90 labor cost and $150 material cost, the prime cost in Department A is $240 with a resulting charge of $240 × 42.86%, or $102.86.

This method is also very simple and is used with some frequency in smaller firms where only a partial application of cost accounting techniques is evident. Thus a company might keep records of direct material and direct labor cost and add a flat percentage of prime cost for manufacturing overhead to all jobs completed.

The method can be criticized on the same bases as were the methods based on percentage direct material cost or direct labor cost. There is a lack of cause-and-effect relationship between the overhead as incurred and the prime cost. The resulting charges to production combine the errors of the material cost method as well as those of the direct labor dollar method.

Effects of Different Methods. The use of different methods for applying manufacturing overhead yields different results as to total cost with regard to a specific lot of goods. To illustrate, assume three producing departments in a plant, A, B, and C, with the details on expected cost and operational data as follows:

	Dept. A	Dept. B	Dept. C	Totals
Direct material cost	$5,000.00	$2,500.00	$2,500.00	$10,000.00
Direct labor cost	$3,000.00	$2,000.00	$3,200.00	$ 8,200.00
Manufacturing overhead	$3,600.00	$2,400.00	$3,000.00	$ 9,000.00
Direct labor hours	2,000	1,800	1,600	5,400
Machine hours	1,800	2,400	2,000	6,200

The rates for the three departments using different methods as described previously, would be:

	Dept. A	Dept. B	Dept. C
Per cent of direct labor cost	120%	120%	93.75%
Rate per direct labor hour	$1.80	$1.33⅓	$1.87½
Rate per machine hour	$2.00	$1.00	$1.50
Per cent of direct material cost	72%	96%	120%
Per cent of prime cost	45%	53.3%	52.6%

To complete the illustration, assume that Job 210 has been finished and the records reveal the following information relative to this job:

	Dept. A	Dept. B	Dept. C	Total
Direct material cost	$20.00	$40.00	$10.00	$ 70.00
Direct labor cost	$56.00	$45.00	$35.00	$136.00
Direct labor hours	40	30	30	100
Machine hours	40	20	45	105

The total cost of this job employing various methods of manufacturing overhead application follows:

	Dept. A	Dept. B	Dept. C	Total
Labor cost method				
Direct material	$ 20.00	$ 40.00	$ 10.00	$ 70.00
Direct labor	56.00	45.00	35.00	136.00
Manufacturing overhead	67.20	54.00	32.81	154.01
Totals	$143.20	$139.00	$ 77.81	$360.01
Labor hour method				
Direct material	$ 20.00	$ 40.00	$ 10.00	$ 70.00
Direct labor	56.00	45.00	35.00	136.00
Manufacturing overhead	72.00	40.00	56.25	168.25
Totals	$148.00	$125.00	$101.25	$374.25
Machine hour method				
Direct material	$ 20.00	$ 40.00	$ 10.00	$ 70.00
Direct labor	56.00	45.00	35.00	136.00
Manufacturing overhead	80.00	20.00	67.50	167.50
Totals	$156.00	$105.00	$112.50	$373.50
Material cost				
Direct material	$ 20.00	$ 40.00	$ 10.00	$ 70.00
Direct labor	56.00	45.00	35.00	136.00
Manufacturing overhead	14.40	38.40	12.00	64.80
Totals	$ 90.40	$123.40	$ 57.00	$270.80
Prime cost				
Direct material	$ 20.00	$ 40.00	$ 10.00	$ 70.00
Direct labor	56.00	45.00	35.00	136.00
Manufacturing overhead	34.20	45.33	23.67	103.20
Totals	$110.20	$130.33	$ 68.67	$309.20

The range in total cost for Job 210 is from $270.80 to $374.25, assuming all departments in the plant use the same method of applying manufacturing expense during the period. As a practical matter, plants generally vary the methods used by different departments because of the essential difference in the productive processes carried on and therefore the manner in which manufacturing overhead is incurred. Applied to this illustration for Job 210, a series of additional answers to the question as to what constitutes total cost could be derived.

Department Rates vs. Over-all Rates. The discussion of rates in this chapter has up to this point been confined for the most part to departmental rates. However, an over-all or blanket rate, that is, a single manufacturing overhead rate to be applied uniformly throughout the plant, does have some practical use. The over-all rate is used in chemical and glass plants producing a main product under continuous process. It may also be used in a plant where several products are produced, provided that all products pass through all departments, that the ratio of one product to another is constant, and that all products utilize the facilities of each department for the same amounts of time.

The over-all rate can be illustrated by referring to the previous illustration. Over-all rates for the plant under the various methods discussed would be as follows:

Per cent of direct labor cost $\frac{\$9{,}000}{\$8{,}200} \times 100 = 109.76\%$

Rate per direct labor hour $\frac{\$9{,}000}{\$5{,}400} = \$1.66\tfrac{2}{3}$

Per cent of direct material cost $\frac{\$9{,}000}{\$10{,}000} \times 100 = 90\%$

Per cent of prime cost $\frac{\$9{,}000}{\$18{,}200} \times 100 = 49.45\%$

A new series of possible total costs could be worked out for Job 210 using these over-all rates.

	Labor	Material	Applied Manufacturing Overhead	Total Cost
Per cent of direct labor cost	$70.00	$136.00	$149.27	$355.27
Rate per direct labor hour	70.00	136.00	166.67	372.67
Per cent of direct material cost	70.00	136.00	63.00	269.00
Per cent of prime cost	70.00	136.00	101.87	307.87

Because of the special conditions necessary for effective employment of the over-all rate, its use is limited. The preference is for departmental, cost center, or machine rates which come much closer to relating the charge for manufacturing overhead to the increase in value of the product resulting from the use of the plant facilities.

Rate per Machine Hour. A machine hour rate represents the cost of operating an individual machine for one hour. The assumptions underlying this device are twofold: that overhead varies with time and that it varies with machine activity. This is understandable, since the machine has more and more taken over the functions of manual labor. In fact it may be said that the machine has altered the entire structure of manufacturing overhead. It has done this by altering the composition of such overhead through the greater emphasis on the fixed charges which nowadays account for such a large part of the manufacturing overhead. Once management has decided to install a new machine it has committed itself to the incurrence, for the life of the machine, of charges covering depreciation, insurance, property taxes, and maintenance.

The derivation of the machine hour rate is illustrated in the following formula:

$$\frac{\text{Manufacturing overhead for a specific machine}}{\text{Machine hours}} = \text{Rate per machine hour}$$

Both numerator and denominator in the above formula represent predetermined elements. Only in rare instances are historical machine hour rates used. While the formula is indeed simple, the collection of information needed in its derivation involves a more refined distribution of manufacturing overhead than was indicated in the previous methods. Beyond distributing overhead to departments, it is now necessary to distribute it further to either cost centers within a department or machines within a cost center or department.

The steps in determining machine hour rates include:

1. Determination of the estimated overhead for the period by departments. This may take the form of a departmental overhead distribution sheet representing the budget for the factory (Figure 74).
2. A new set of overhead distribution sheets is then started, one for each department. To these sheets are transferred the respective departmental figures (Figure 75). Across each sheet a separate column is provided for the overhead connected with each machine.
3. On each of the new sheets every overhead item is then distributed across the page to the proper machines (Figure 75). Some of the overhead represents specific charges against the machine, such as depreciation on machinery, insurance on machinery and power. Others, such as factory supplies and indirect labor, particularly supervisory labor, are more general in nature and must be prorated to the machines on various bases. These may include area, cubic content as well as others discussed in the chapter on manufacturing overhead distribution. Finally, each department's share of service department charges is prorated to the machines (Figure 75).
4. The columns representing the charges to each machine are then totaled (Figure 75).
5. The totals are divided by the estimated number of hours of operation (Figure 75). The estimated hours may take into account the time for setups and other unavoidable delays. In some cases, separate rates are set for setup and for running time.

After the machine hour rates have been determined it is possible to apply the proper manufacturing overhead to the product. For example, if a batch of 20 gears spent 18.1 hours on one of the machines in Group I and 13.2 hours on a Group II machine, the total overhead charged in Department 16 may be calculated as follows:

Group I, 18.1 hours at $2.392	$42.30
Group II, 13.2 " " $1.829	24.14
Total applied overhead	$66.44

Since 20 good gears were produced the overhead cost per gear figures out to $3.322.

	Basis of Distribution	Total	Dept. 16 Bar Machine	Dept. 17 Grinding	Dept. 100 Tool Crib	Dept. 101 Power	Dept. 102 Building Expense	Dept. 103 Factory Administration
Indirect Labor (including Supervision)		$ 50,000.00	$ 5,000.00	$ 6,000.00	$3,000.00	$ 8,000.00	$ 9,000.00	$19,000.00
Compensation Insurance		3,500.00	700.00	700.00	200.00	500.00	600.00	800.00
Supplies		5,000.00	400.00	500.00	300.00	1,000.00	800.00	2,000.00
Small Tools Purchased		11,500.00	6,000.00	4,000.00	–	500.00	1,000.00	
Tool and Equipment Maintenance		3,500.00	1,000.00	1,500.00	200.00	500.00	300.00	
Depreciation on Machinery and Equipment		8,500.00	3,000.00	4,000.00		1,000.00	500.00	
Taxes on Machinery and Equipment		2,500.00	800.00	700.00		800.00	100.00	100.00
Insurance on Machinery and Equipment		3,000.00	1,200.00	1,000.00		500.00	100.00	200.00
Depreciation on Building		5,000.00					5,000.00	
Taxes on Building		3,000.00					3,000.00	
Insurance on Building		2,000.00					2,000.00	
Building Maintenance		5,000.00					5,000.00	
Total Primary Charges		$102,500.00	$18,100.00	$18,400.00	$3,700.00	$12,800.00	$27,400.00	$22,100.00
Service Department Distributions								
Factory Administration	Number of workers		8,287.00	9,392.00	1,105.00	1,658.00	1,658.00	$(22,100.00)
Building Expense	Area		6,974.00	12,785.00	3,487.00	5,812.00	($29,058.00)	
Power	Horsepower rating		9,122.00	11,148.00		($20,270.00)		
Tool Crib	Value of machines		3,317.00	4,975.00	($8,292.00)			
		$102,500.00	$45,800.00	$56,700.00				
Bases of Distribution								
Number of workers		40	15	17	2	3	3	—
Area (in sq. ft.)		5,000	1,200	2,200	600	1,000		
Horsepower rating		200	90	110			—	
Cost of machines		$125,000.00	$40,000.00	$60,000.00		$15,000.00	$10,000.00	

FIGURE 74. Estimated Annual Manufacturing Overhead by Departments

DEPARTMENT 17. BAR MACHINES

	Basis of Distribution	Unit Cost	Total-Dept. 16	Group I 4 Machines	Group II 4 Machines	Group III 3 Machines	Group IV 1 Machine
Basic Data							
Floor Space (sq. ft.)		$ 5.8116	1,200	400	300	300	200
Equipment (cost)			$40,000.00	$12,000.00	$10,000.00	$ 8,000.00	$10,000.00
Horsepower rating		$101.35	90	25	15	30	20
Number of machine hours			18,500	6,200	6,200	4,600	1,500
Number of workers		$552.50	15	6	4	3	2
Manufacturing Overhead							
Indirect Labor	Machine hours		$ 5.000.00	$ 1,676.00	$ 1,676.00	$ 1,243.00	$ 405.00
Compensation Insurance	Machine hours		700 00	235.00	234.00	174.00	57.00
Supplies	Direct charges		400.00	150 00	75.00	50.00	125.00
Depreciation on Machinery	Cost of equipment		3,000.00	900.00	750.00	600.00	750.00
Taxes on Machinery	Cost of equipment		800.00	240.00	200.00	160.00	200.00
Insurance on Machinery	Cost of equipment		1,200.00	360.00	300.00	240.00	300.00
Small Tools Purchased	Cost of equipment		6.000.00	1,800.00	1,500.00	1,200.00	1,500.00
Tool and Equip. Maintenance	Direct charges		1,000 00	300.00	300.00	200.00	200.00
Total Primary Charges			$18,100.00	$ 5,661.00	$ 5,035.00	$ 3,867.00	$ 3,537.00
Service Dept. Distributions							
Factory Administration	Number of employees		8,287.00	3,315.00	2,210.00	1,657.00	1,105.00
Building Expense	Floor space		6,974.00	2,325.00	1,743.00	1,744.00	1,162.00
Power	Horsepower rating		9,122.00	2,534.00	1,520.00	3,041.00	2,027.00
Tool Crib	Cost of equipment		3,317.00	995.00	829.00	663.00	830.00
Total Overhead			$45,800.00	$14,830.00	$11,337.00	$10,972 00	$ 8,661.00
Machine Hour Rate				$ 2.392	$ 1.829	$ 2.385	$ 5.774

FIGURE 75. Development of Machine Hour Rates

The machine hour method provides an effective method for applying overhead in manufacturing processes, particularly of the automatic mechanical type where the significant costs in the department relate to machines. Note also that this method uses time as a basis for applying manufacturing overhead and that in one way or another it pinpoints the expense to individual machines. The important objections to the machine hour method are as follows:

1. Additional information, not otherwise needed, must be provided in detail, i.e., machine time for each operation. This increases the cost of the accounting procedure, and hence some concerns do not find it practicable to use a machine hour rate.
2. By its very nature this method precludes use of a blanket rate. Individual or group machine rates must be used, thus increasing the detailed cost work.

Journal Entries for Applying Manufacturing Overhead. At the end of the accounting period, the total of the manufacturing overhead applied to production during the period is recorded by a journal entry as follows:

Work in Process	$xx.xx	
Manufacturing Overhead Applied		$xx.xx

The entry charges work in process for manufacturing overhead based on actual or predetermined rates. At the end of the accounting period the applied overhead is compared with the actual manufacturing overhead.

If it is assumed that the actual expenses for the month were charged to Manufacturing Overhead (Actual), the following entries indicate the closing of the Manufacturing Overhead (Actual) and the determination of the over- or underabsorbed manufacturing overhead. If the actual manufacturing overhead is *greater* than the applied manufacturing overhead, the entry is as follows:

Manufacturing Overhead Applied	$xx.xx	
Underabsorbed Manufacturing Overhead	xx.xx	
Manufacturing Overhead (Actual)		$xx.xx

If the actual manufacturing overhead is *less* than the applied manufacturing overhead, the following entry is made:

Manufacturing Overhead Applied	$xx.xx	
Overabsorbed Manufacturing Overhead		$xx.xx
Manufacturing Overhead (Actual)		xx.xx

Disposition of Under- and Overabsorbed Manufacturing Overhead. The monthly differences may be of considerable size due to seasonal factors, but for the year as a whole, the difference should not be great. Under ordinary circumstances the monthly differences are carried forward, and only the year-end amount of over- or underabsorbed overhead needs disposition.

The disposition of under- and overabsorbed manufacturing overhead is essentially a problem related to closing the books and preparing operating statements. Since the transfer entries from Work in Process to Finished Goods and from Finished Goods to Cost of Sales are made on the basis of predetermined overhead rates, the work in process inventory, the inventory of finished goods, and cost of sales are understated in case of underabsorption and overstated where overabsorption occurs.

Four methods are available for disposing of the balance of under- or overabsorbed manufacturing overhead:

1. Charge to cost of sales
2. Charge to profit and loss
3. Apportion between inventories and cost of sales through the use of supplementary rates
4. Carry to a reserve account

CHARGE TO COST OF SALES. In practice the under- or overabsorbed manufacturing overhead is closed to cost of sales most frequently, according to a survey by the National Association of Cost Accountants. In the profit and loss statement it is shown as an offset to cost of sales. This practice is followed both for monthly closings and statements and final end-of-year closing and reporting.

CHARGE TO PROFIT AND LOSS. Some accountants suggest the closing of under- or overabsorbed manufacturing overhead to profit and loss and its classification in the profit and loss statement under "other expense" or "other income" under the theory that the over- or underabsorption results from operating the plant below or above the level of output used in setting the manufacturing rates. The actual level of output achieved depends upon forces beyond the control of the factory manager, such as the effectiveness of the sales department and external economic conditions. Hence, under- or overabsorbed manufacturing overhead may be classified as other expense or income.

APPORTIONMENT BETWEEN INVENTORIES AND COST OF SALES THROUGH SUPPLEMENTARY RATES. Where over- or underabsorbed overhead is apportioned to inventories and cost of sales, it is due to a desire to reflect actual costs in these accounts. This may be accomplished through the use of supplementary overhead rates. As the name implies, they are used in connection with other rates. The formula for the supplementary rate is:

$$\frac{\text{Under- and overabsorbed manufacturing overhead}}{\text{Hours, dollars, or units}} = \text{Supplementary rate}$$

To illustrate, assume the following information is furnished regarding production for the month of February:

	Direct Materials	Direct Labor	Manufacturing Overhead Applied *	Total
Work in process	$ 500.00	$ 800.00	$ 1,200.00	$ 2,500.00
Finished goods	9,000.00	12,000.00	18,000.00	39,000.00
Cost of sales	27,000.00	36,000.00	54,000.00	117,000.00
	$36,500.00	$48,800.00	$73,200.00	$158,500.00

* Rate used is 150% of direct labor cost.

At the end of the month, the total in the actual manufacturing overhead account was $75,640. The journal entry to close this expense would be:

Manufacturing Overhead Applied	$73,200.00	
Underabsorbed Manufacturing Overhead	2,440.00	
Manufacturing Overhead (Actual)		$75,640.00

The supplementary rate is then determined as follows:

$$\frac{\$75{,}640 - \$73{,}200}{\$48{,}800} \times 100 = 5\%$$

The underabsorbed overhead is to be spread to production on the basis of this percentage. The disposition of the underabsorbed overhead is as follows:

Work in process	($ 800 × 5%) =	$ 40.00
Finished goods	($12,000 × 5%) =	600.00
Cost of sales	($36,000 × 5%) =	1,800.00
		$2,440.00

The journal entry to accomplish this application of expense is:

Work in Process	$ 40.00	
Finished Goods	600.00	
Cost of Sales	1,800.00	
Underabsorbed Manufacturing Overhead		$2,440.00

To charge production for underabsorbed manufacturing overhead at a supplementary rate of 5%.

As the formula indicates, supplementary rates may be used based on hours (labor hours or machine hours) or even on units of product. Their principal advantage lies in the fact that they make possible the costing of total actual overhead to the product produced. This is the case on government contracts run on a cost-plus basis (cost being defined as actual cost for the period of the specific contract). Supplementary rates, properly computed, offer one means of achieving actual cost in so far as the overhead element is concerned.

On the other hand, final disposition of the cost sheets is delayed until after the close of each month; also, the use of supplementary rates greatly increases the detailed cost work, since job cost cards must be recomputed. In a seasonal business where estimated rates have been determined for a year in advance in order to smooth out irregularities of costing due to the nature of the industry, it is inequitable to apply total actual overhead for any one month to the total product for that month. Rather, the underabsorbed overhead in one month is offset by overabsorbed overhead in another month. When the net amount of variation between actual and absorbed overhead is determined at the close of the year, it is too late to recompute all the cost sheets by the use of supplementary rates.

CARRY TO A RESERVE ACCOUNT. This method is used most frequently in monthly closings. It results in a debit or credit balance to a reserve for under- or overabsorbed overhead which would be carried in the balance sheet as a deferred credit where overabsorbed manufacturing overhead is shown.

The method is justified on the grounds that the predetermined overhead rate is constant throughout the year and that the primary cause for under- or overabsorbed expense is seasonal fluctuation in output. At the end of the year the balance in the reserve for under- or overabsorbed manufacturing overhead is usually relatively small and could be closed to profit or loss or cost of sales.

Theoretically one could expand this concept to carrying the reserve balance from year to year assuming a balancing off of under- and overabsorbed overhead over the period of a business cycle. However, manufacturing overhead rates are rarely set and left unmodified for so long a period.

Guides to the Selection of a Method. The following points are listed as criteria to be used in selecting a method for applying manufacturing expenses:

1. The method selected should use as its base the main productive element in the particular manufacturing operation; i.e., it should relate manufacturing overhead to the product in a logical way.
2. Separate rates should be established for each area that constitutes a homogeneous cost unit from the point of view of obtaining correct product costs. In some cases, this may mean cost center or operation rates; in others, blanket rates.
3. The method or methods adopted should make possible monthly profit and loss statements of operating significance, as well as facilitate the compilation of special reports.
4. Other things being equal, departmental rates or cost center rates are superior to blanket rates, because of the greater flexibility of the former.

5. Other things being equal, rates based on time (labor hours or machine hours) are to be preferred to rates based on a variable cost factor (labor dollar, material cost). This is because many important expense items, particularly fixed charges, are functions of time (depreciation, fire insurance, and rent).

QUESTIONS

1. Give three reasons for using a machine hour rate for overhead application.
2. Explain the probable reasons for underabsorbed overhead where a machine hour rate is in use.
3. Discuss the advantages and disadvantages in considering the use of supplementary burden rates.
4. Assume that, at the end of January, the over- or underabsorbed manufacturing overhead account showed a debit balance in the amount of $910. Indicate the effect on cost of goods sold, inventories, and net profit for both January and February.
5. The Frank Company has for some years used a predetermined labor dollar rate for applying manufacturing overhead. A recent survey reveals that this method was poorly selected and that a machine hour rate is far better suited for the company. Has there been any effect on net profit of prior years and on costs of individual products as a result of this choice? Explain.
6. Explain how predetermined manufacturing overhead rates may be used in connection with a process cost system.
7. Explain the treatment of over- and underabsorbed manufacturing overhead where departmental rates are used.
8. The AB Manufacturing Company manufactures a variety of products, which range in size and price from small and inexpensive articles to large and costly machines. Its operations are highly departmentalized and its manufacturing expenses are allocated to departments for each of which an overhead rate has been established. Explain how you would satisfy yourself as to the correctness of the application of the manufacturing overhead in determining the cost of the various products manufactured and sold.
9. The prevailing practice in the disposition of over- and underabsorbed manufacturing overhead is to close it to cost of sales. Do you recommend this for a seasonal business in connection with preparing (*a*) monthly statements; (*b*) annual statements? Explain. What alternative method or methods can you suggest in answer to (*a*)?
10. Under what conditions is it preferable to use product units rather than labor or machine hours for applying manufacturing overhead?

11. The problem of charging inspection costs to products depends on the nature of the productive process. What suggestions would you make in this connection with regard to a gray iron foundry and machine shop operating on:

    a) Job order basis
    b) Process basis
    c) Combination jobs and process basis

12. A manufacturing concern which uses a historical cost system and applies manufacturing overhead on the basis of predetermined rates has the following accounts on its books at the end of its fiscal year:

Manufacturing overhead (debit)	$217,384.00
Manufacturing overhead applied (credit)	182,952.00
Work in process (debit)	70,740.00
Finished goods (debit)	115,366.00
Cost of goods sold (debit)	420,294.00

    You are to give two acceptable methods of disposing of the $217,384 Manufacturing Overhead and the $182,952 Manufacturing Overhead Applied balances, and give the arguments for and against each method, setting forth any necessary assumptions you make.

13. The West Electric Corporation manufactures electrical products and conducts continuous research for new products, product improvement, product defect analysis, and a number of other purposes. The research is departmentalized for the purpose of cost collection as follows: metallurgy, electronics, circuits, photonics, chemistry, and electrochemistry.

    Discuss the accounting treatment of the research costs of the West Electric Corp. giving consideration to:

    a) Amount to be charged to cost each period
    b) Amount to be charged to different product lines

14. The Photon Radio Company manufactures radios and from time to time charges its vendors for the cost of reworking defective material purchased. To date it has charged vendors for the material and direct labor cost involved in reworking, excluding any charge for manufacturing overhead. Discuss:

    a) The effect of this practice on current costing procedure
    b) The propriety of charging the overhead on rework as a cost to the purchasing department
    c) The considerations involved in a change of policy resulting in a charge to the supplier for manufacturing overhead as well

15. Under which of the following circumstances should the manufacturing overhead rate be revised?

    a) Handwork operations are replaced by semi-automatic machines to do the same work with fewer operators.
    b) Company signs new contract with union providing for increase of 15 cents an hour in wages.
    c) Inability to obtain materials causes plant to run at 40% capacity.

d) Maintenance costs in excess of standard cause underabsorption of overhead.
e) Overhead is overabsorbed due to high volume of sales.
f) Addition of a second shift increases both expenses and volume.

What disposition would you make of the under- or overabsorbed overhead balance in each case?

16. In 1946 the XX Company added a new wing to its factory building and installed machinery to make out of plastic a product which had previously been made from steel. At this time steel was unobtainable and the entire output of the plastic product could be sold at a profitable price. However, by 1948 ample supplies of steel were again available and since the product made from steel was more durable and sold at the same price, the plastic product could no longer be sold. The company disposed of the machinery but has no other use for the building space. How should the costs of carrying this idle space be handled?
17. Is a low ratio between factory overhead and direct labor an indication of operating efficiency?

Chapter 14

JOB ORDER COSTS

Nature of Job Order Costs. The special order or job order type of production, where a specific job is done for a stipulated price, requires a complete record of cost for the job. A job order cost system can be defined as one which collects separately each element of cost for each job or order worked on by the plant. The system is widely used in many industries, such as job printing, manufacture of special types of machinery, building and public works, construction work for the complete job and for portions subcontracted, and by producers of differentiated lots of goods. It is also widely used as incidental to some other system of cost accounting. Even a continuous process plant operating under a process cost system may well use a job order cost system for ascertaining the cost of factory maintenance and repair, the cost of special research projects, and the cost of constructing machinery and equipment for use in the plant.

Principles of Job Order Costing. The essentials of a job order cost system are:

1. An order number is assigned to each job or lot of product for which costs are to be collected.
2. A job cost sheet (Figure 76) is prepared for each order and all costs relative to the order are recorded thereon.
3. Direct materials used are recorded on the job cost sheet.
4. Direct labor cost is posted to the job cost sheet.
5. Manufacturing overhead is added to the job cost sheet usually based on a predetermined rate.
6. A work in process account.

This account is carried in the general ledger or factory ledger and serves as a controlling account for the individual cost sheets. It is therefore debited in total for the three manufacturing cost components mentioned above. The same account is credited for the sum of the total costs indicated on the job cost sheets for those orders completed in the course of the month, as shown by a summary of completed production orders. The balance of Work in Process represents the dollar value of the inventory of work in process and is of course equal to the sum of the totals of the job cost sheets for orders not completed at the close of the month.

An alternative treatment requires the use of three work in process accounts, one each for materials in process, labor in process, and manufacturing overhead in process.

Forms Used. Forms most characteristic of, and most commonly associated with, specific order systems are:

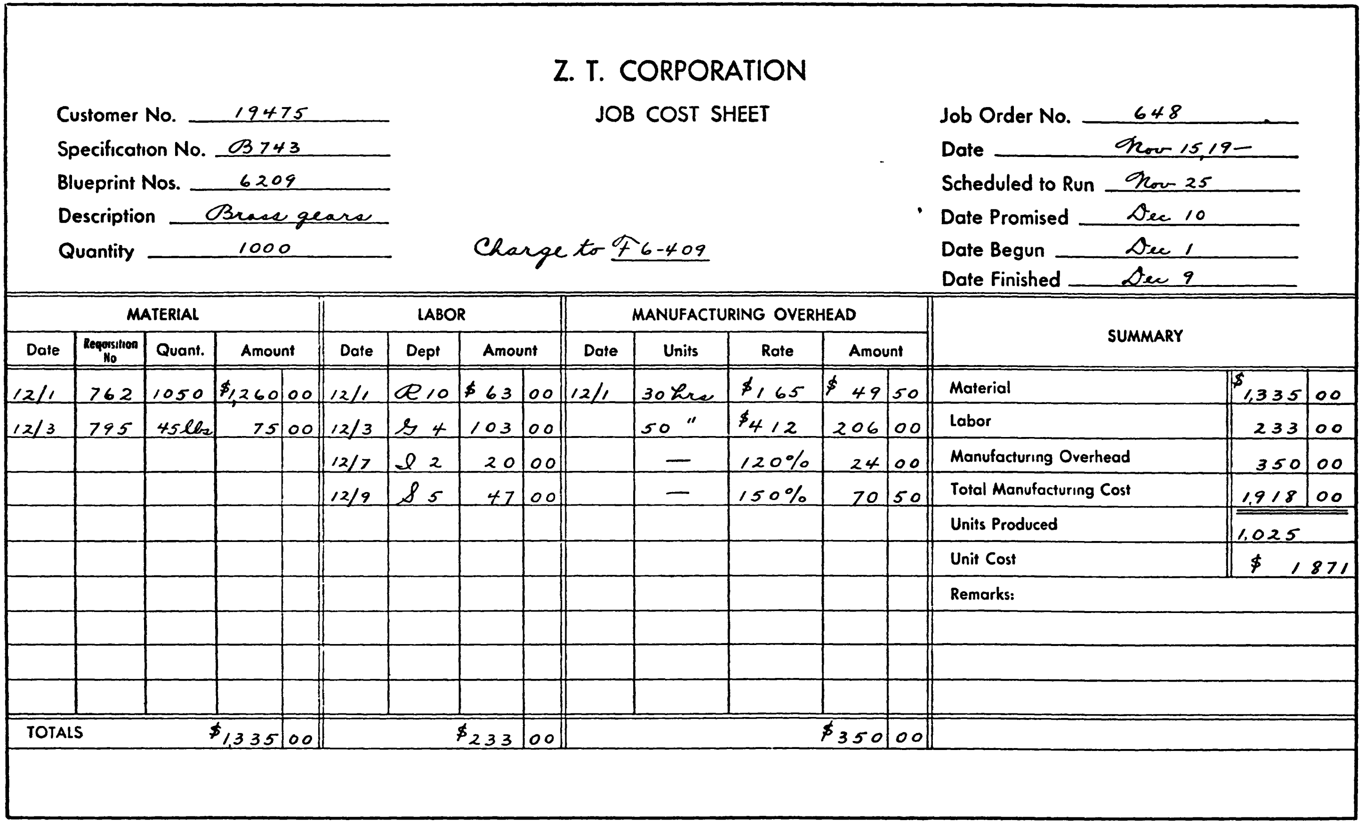
1. Production order
2. Bill of materials
3. Operations schedule
4. Tool list
5. Planning or work-ahead board
6. Move ticket or route card
7. Cost sheet

In addition some physical equipment is usually required, comprising a time clock for stamping starting and finishing time of jobs, and a production control board or suitable Gantt charts. In some types of work, e.g., in shipbuilding, construction work, etc., a roving timekeeper takes the place of the usual time clock for keeping a record of jobs worked on.

Production order. Under a job order system production can be carried on only by means of specific production orders. Hence management must plan the scheduling of production orders in such a way as to yield a minimum of lost time. The following is a brief discussion of production control applicable to job order conditions.

The production order is a written authority to factory foremen to proceed with a job. It is not released to the factory until the date set in the planning schedule. Figure 76 shows a simple form acting as combined production order and cost sheet. Figure 77 shows a production order for parts to be manufactured for stock. Note spaces provided at the bottom of the form for initials of persons taking care of the many details in connection with the preparation of the order.

Bill of materials. A bill of materials is prepared on the basis of plans and specifications forming a part of the contract with a customer, or on a basis of filed specifications if parts are to be manufactured for stock. It contains a complete list of all materials and parts required for a given job. The form illustrated in Figure 78 is on tracing cloth which permits blueprint duplication. The last three columns to the right are blacked out on the tracing so that they appear white on the blueprint and therefore are available for cost postings for material, labor, and overhead. In the "number required" column both the unit number and the total for the job are shown.



Z. T. CORPORATION

JOB COST SHEET

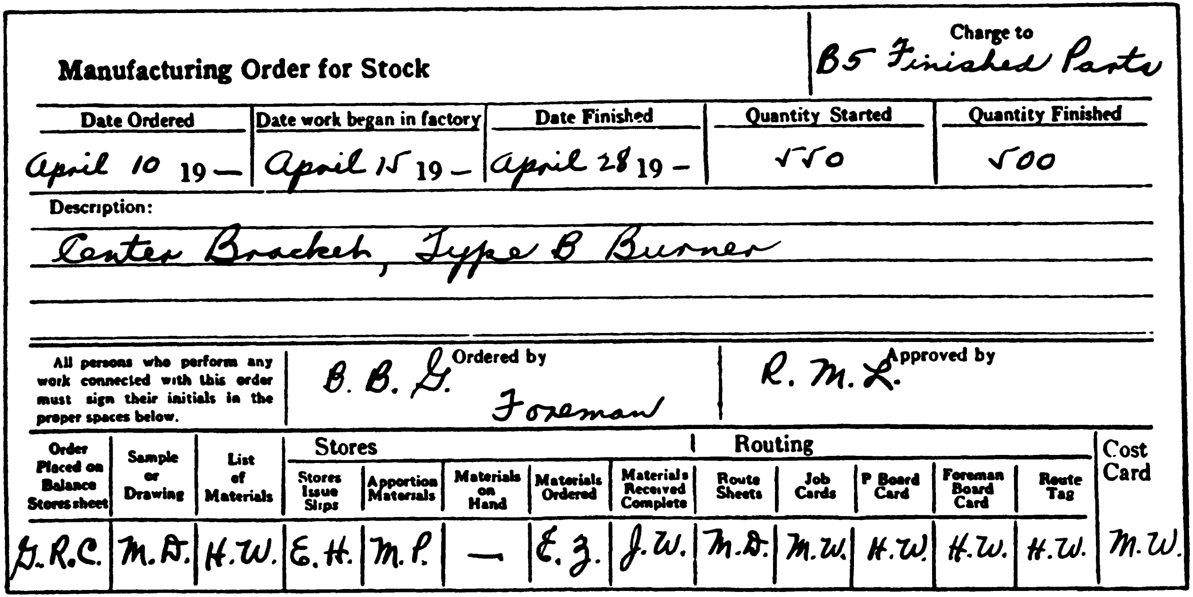
Customer No. 19475
Specification No. B743
Blueprint Nos. 6209
Description Brass gears
Quantity 1000

Charge to F6-409

Job Order No. 648
Date Nov 15, 19—
Scheduled to Run Nov 25
Date Promised Dec 10
Date Begun Dec 1
Date Finished Dec 9

MATERIAL				LABOR			MANUFACTURING OVERHEAD				SUMMARY	
Date	Requisition No	Quant.	Amount	Date	Dept	Amount	Date	Units	Rate	Amount		
12/1	762	1050	$1,260 00	12/1	R 10	$ 63 00	12/1	30 hrs	$1 65	$ 49 50	Material	$1,335 00
12/3	795	45 lbs	75 00	12/3	G 4	103 00		50 "	$4 12	206 00	Labor	233 00
				12/7	I 2	20 00		—	120%	24 00	Manufacturing Overhead	350 00
				12/9	S 5	47 00		—	150%	70 50	Total Manufacturing Cost	1,918 00
											Units Produced	1,025
											Unit Cost	$ 1871
											Remarks:	
TOTALS			$1,335 00			$233 00				$350 00		

FIGURE 76. Job Cost Sheet



Manufacturing Order for Stock

Charge to B5 Finished Parts

Date Ordered	Date work began in factory	Date Finished	Quantity Started	Quantity Finished
April 10 19—	April 15 19—	April 28 19—	550	500

Description: Center Bracket, Type B Burner

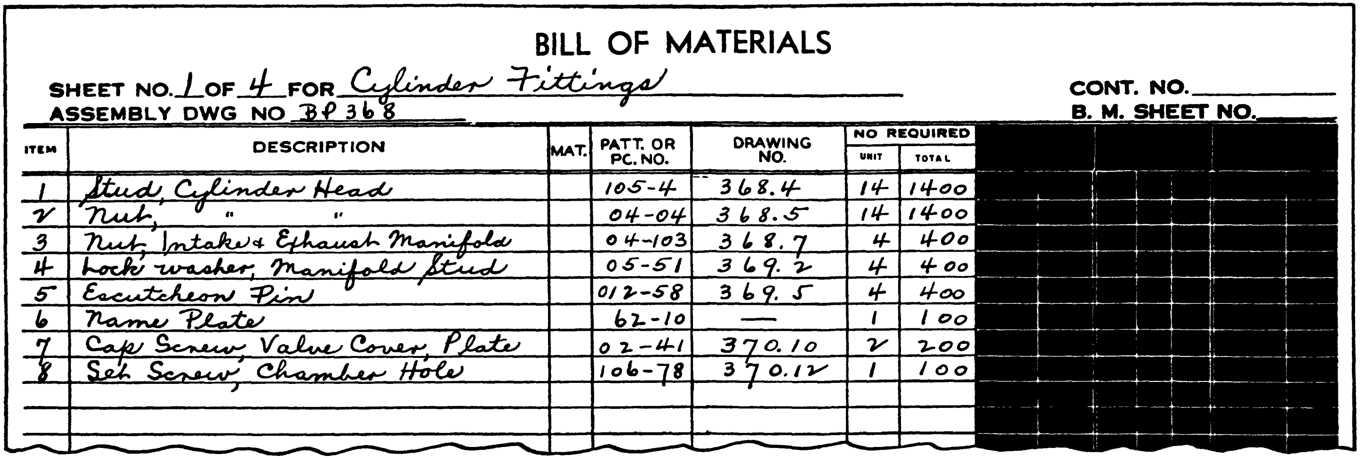
All persons who perform any work connected with this order must sign their initials in the proper spaces below.

Ordered by B. B. G. Foreman

Approved by R. M. L.

Order Placed on Balance Stores sheet	Sample or Drawing	List of Materials	Stores					Routing					Cost Card
			Stores Issue Slips	Apportion Materials	Materials on Hand	Materials Ordered	Materials Received Complete	Route Sheets	Job Cards	P Board Card	Foreman Board Card	Route Tag	
G.R.C.	M.D.	H.W.	E.H.	M.P.	—	E.Z.	J.W.	M.D.	M.W.	H.W.	H.W.	H.W.	M.W.

FIGURE 77. Parts Production Order



BILL OF MATERIALS

SHEET NO. 1 OF 4 FOR Cylinder Fittings
ASSEMBLY DWG NO BP 368

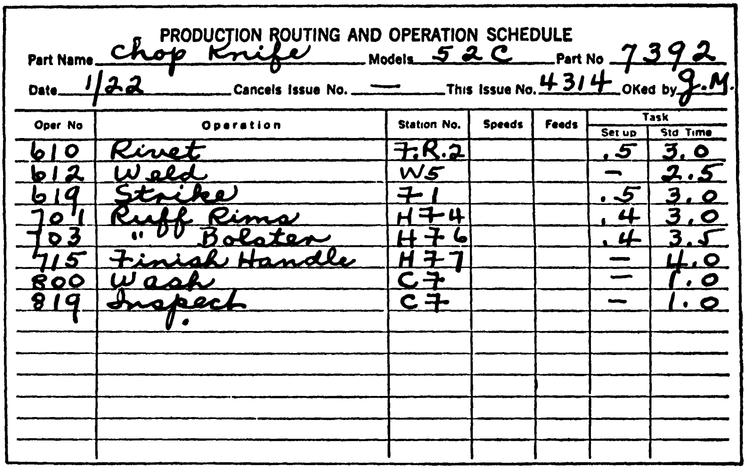
CONT. NO.
B. M. SHEET NO.

ITEM	DESCRIPTION	MAT.	PATT. OR PC. NO.	DRAWING NO.	NO REQUIRED	
					UNIT	TOTAL
1	Stud, Cylinder Head		105-4	368.4	14	1400
2	Nut, " "		04-04	368.5	14	1400
3	Nut, Intake & Exhaust Manifold		04-103	368.7	4	400
4	Lock washer, Manifold Stud		05-51	369.2	4	400
5	Escutcheon Pin		012-58	369.5	4	400
6	Name Plate		62-10	—	1	100
7	Cap Screw, Valve Cover, Plate		02-41	370.10	2	200
8	Set Screw, Chamber Hole		106-78	370.12	1	100

[redacted]

FIGURE 78. Bill of Materials

Bills of materials may also act as substitutes for stores requisitions. They are often used as authorizations to the storeroom to issue the required material at the stated time. The foreman's copy attached to the production order is his authorization to call for and receive such materials.



PRODUCTION ROUTING AND OPERATION SCHEDULE

Part Name Chop Knife Models 52C Part No 7392

Date 1/22 Cancels Issue No. — This Issue No. 4314 OKed by J.M.

Oper No	Operation	Station No.	Speeds	Feeds	Task	
					Set up	Std Time
610	Rivet	7.R.2			.5	3.0
612	Weld	W5			—	2.5
619	Strike	71			.5	3.0
701	Ruff Rims	H74			.4	3.0
703	" " Bolster	H76			.4	3.5
715	Finish Handle	H77			—	4.0
800	Wash	C7			—	1.0
819	Inspect.	C7			—	1.0

FIGURE 79. Production and Operation Schedule

OPERATION SCHEDULE. On this schedule are listed by name and code number all labor operations to be performed in their proper sequence. In this way the schedule serves also as route sheet or production schedule. Figure 79 shows such a combination production and operation schedule. It has spaces showing the machines or stations where work is to be done, and instructions regarding the manner in which the work is to be performed. Where the work is more complex, separate instruction cards are made out for each operation, showing how the work is to be performed. These accompany the operations schedule.

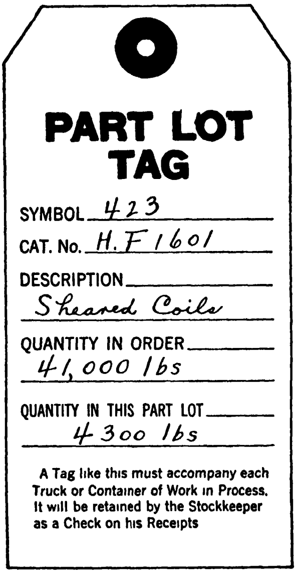
TOOL LIST. A list of tools required, whether special or standard, is prepared and accompanies the instruction cards and operations schedule. In this way, the operations schedule and tool list take care of production problems relating to labor, machines, and tools.

PLANNING OR WORK-AHEAD BOARD. A planning board is in effect a time table for scheduled production. It is ordinarily based on a planning schedule whose function is to set time limits for processing the various jobs or orders. The board is simply a rack with suitable hooks or receptacles to hold the production order control card. Each work station at which an operator is required, whether machine, bench, or assembly floor, is represented on the production control board by a work station number. This is necessary to secure proper functioning of the production control for effective results. The number is placed across the top so as to be easily recognized by the respective operators. To aid in the control of the jobs passing through the shop, the hooks or receptacles should be placed in three horizontal rows across the board or three divisions under each work station. This is to permit differentiation between jobs or orders being worked upon, those waiting next in turn, and those that may have been held up during the progress of production for causes that so frequently happen in any shop.

This equipment should be centrally located. The time clock or stamp should be located close at hand for immediate use.

MOVE TICKET. As work on the order progresses, it is checked off on the operations schedule which frequently is used as a route sheet, showing in chronological order the steps required in its completion. Identification tags (Figure 80) accompany each lot at time of transfer to the next department. The planning board is adjusted to record the progress made.

JOB COST SHEET. The heart of the system of cost accounting for specific jobs is the job cost sheet (Figure 76). This record shows all costs relative to a job for actual direct material and direct labor consumed as well as a charge for overhead incurred at predetermined rates. Furthermore, the job cost sheets for those jobs in process at the end of the accounting period provide the subsidiary ledger detail for the controlling account Work in Process, thus affording a book inventory suitable for checking against the physical inventory. Similarly, the job cost sheets for finished orders not shipped support the controlling account Finished Goods, while the job cost sheets for orders finished and shipped support the account Cost of Sales and serve as a basis for a detailed cost report furnished along with the usual financial statements.



PART LOT TAG

SYMBOL 423

CAT. No. H.F 1601

DESCRIPTION Sheared Coils

QUANTITY IN ORDER 41,000 lbs

QUANTITY IN THIS PART LOT 4300 lbs

A Tag like this must accompany each Truck or Container of Work in Process. It will be retained by the Stockkeeper as a Check on his Receipts

FIGURE 80. Identification Tag

A further use for the job cost sheets for completed jobs is the information provided which serves as a basis for checking production cost against estimated cost thus aiding in the control of cost, as a guide to pricing (where cost is a determinant), and as an indication of the relative profitability of different types of goods produced.

Direct Materials. The source for posting direct material cost to the job cost sheet is the stores requisition. The stores requisitions are first posted to the stores records at which time they are priced and extended; and if they are afterward arranged by job number, posting to the job cost sheet is facilitated.

Materials issued in excess of those required for a particular job should be returned to stores. A form similar to the stores requisition but of different color and specifically noted "Materials Returned to Stores" is used. The stores records are posted for the returned goods and the job cost sheet must show an entry in red in the material section. The returned materials are summarized in a manner similar to that for issued materials.

The entry for scrap produced on an order is the same as above with the exception that the posting to the stores ledger is to a special card for scrap rather than to the original material stores ledger card.

Defective work may often be discovered by inspectors before the job is completed. If not apparent in the course of regular process inspection it might be uncovered by the customer receiving the finished goods. In either case the defective goods may be repaired or, if beyond repair, scrapped.

The cost of repairing goods is generally charged to manufacturing overhead and specifically against the departments responsible for the particular part of the job. Where the defect is discovered before the goods are shipped, the goods are routed back to the department and the defect overcome. If the goods are returned by a customer, a new production order and job cost sheet are prepared and when the total cost is accumulated it is then charged to manufacturing overhead of the department responsible for the defective work.

Labor. The cost of labor is derived from the time ticket. The completed time ticket accounts for labor's time by jobs for direct labor and by departments for indirect labor. A further breakdown in terms of nature of operation using code number designations may also be used. The hours and minutes indicated are converted to money value by the payroll department using weekly, hourly, piece, or bonus rates. The time tickets for direct labor are then ready for sorting according to production order numbers and, after sorting, are posted to the job order cost sheets.

The time tickets are next sorted by departments and are analyzed according to direct and indirect labor for recording on a labor distribution sheet. This latter form serves as the basis for the monthly labor distribution entry charging Work in Process and Manufacturing Overhead and crediting Factory Payroll.

Manufacturing Overhead. The procedure for charging the job cost sheets and Work in Process for manufacturing overhead consists of adding a predetermined or estimated amount for manufacturing overhead as explained in an earlier chapter. Accordingly, the manufacturing overhead chargeable is determined as shown below if the following conditions are assumed:

Producing Department	Department Overhead Rate	Job Number 4697
A	$1.00 per direct labor hour	400 direct labor hours in Dept. A
B	$.50 per machine hour	650 machine hours in Dept. B
C	30% of direct labor cost	$1,200 direct labor incurred in Dept. C

The charge for estimated overhead for Job Number 4697 is then derived:

Department A ($1.00 × 400) = $ 400.00
Department B ($.50 × 650) = 325.00
Department C (30% × $1,200) = 360.00
Total overhead charged to Job Number 4697 $1,085.00

The posting to the job sheet for the applied manufacturing overhead may be made weekly, monthly, or when the order is completed. A summary is prepared for the charges made to job cost sheets for manufacturing overhead during the current accounting period, including both completed orders and orders still in process. The summary is the basis for the usual journal entry charging Work in Process and crediting Manufacturing Overhead Applied.

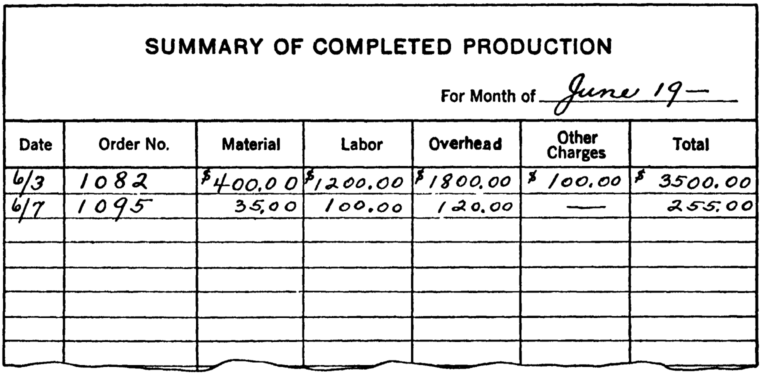
Completed Production. When goods are completed, they are turned over to finished stock or to the shipping department. Notice to the cost department is given through a finished stock debit memo or similar document. The cost department then goes through the following routine:

1. Removes the cost sheet from the active file
2. Completes the cost sheet by supplying missing postings
3. Computes total and unit costs on this order for use by the finished stock ledger clerk, and subsequent use in costing sales
4. Enters cost sheet data on a summary of completed production orders (Figure 81) and files the cost sheet
5. At the end of the month prepares a journal voucher on the basis of the completed order summary

The usual summary journal entry is made from the completed order summary.

Valuing Work in Process. The value of work in process at the end of an accounting period is represented by the balance in the Work in Process account. The verification of this balance is possible by listing the totals shown to this point on the job cost sheets for jobs not yet finished. Care should be taken to check that manufacturing overhead at predetermined rates has been added to actual direct material and labor consumed to this point.

Finished Goods and Cost of Sales. As noted above, the debit to Finished Goods is derived from the summary of completed production (Figure 81). Since the total cost of each order is available when the invoice is prepared, or within a reasonable time thereafter, the summary entry for the sales for any month can be followed by an entry to record the cost of sales. It is the practice of many firms to enter on their file copies of the sales invoice the total cost to produce the goods invoiced.



SUMMARY OF COMPLETED PRODUCTION

For Month of June 19—

Date	Order No.	Material	Labor	Overhead	Other Charges	Total
6/3	1082	$400.00	$1200.00	$1800.00	$ 100.00	$ 3500.00
6/7	1095	35.00	100.00	120.00	—	255.00

FIGURE 81. Completed Order Summary by Cost Elements

After the summary entry for cost of sales has been made, the balance in the Finished Goods account represents the value of finished goods on hand at the end of the accounting period. This balance is checked to the subsidiary record, in this case, the job cost sheets for completed orders not yet shipped. Periodic verification of the physical inventory to the book inventory is recommended.

Financial Statements and Other Summaries. The financial statements under a job order system are no different from statements prepared under other cost systems.

In addition to the usual financial statements special summaries are sometimes prepared. In the case of job order plants it is not uncommon to prepare special cost sheets particularly on orders involving heavy expenditures of time and money. The purpose of these summaries may be for comparison with past orders for similar work, as a basis for cost and price estimates on future work, or as general reference in budgeting. This is well illustrated in Figures 82 and 83. In the former a weekly summary of costs on a special order for fifty airplanes is given. It

ACTUAL COST COMPARISON WITH ESTIMATED COST

Order A31—Quantity of 50

Week Ending September 27, 19—

No.	Description	Current Week			Actual Cost to Date			Estimated Total		
		Material	Labor	Total	Material	Labor	Total	Material	Labor	Total
0	Wing Group	$ 6,000	$ 3,000	$ 9,000	$13,000	$ 6,500	$ 19,500	$ 400,000	$ 60,000	$ 460,000
1	Tail Group	5,000	4,000	9,000	9,000	7,000	16,000	300,000	75,000	375,000
2	Body Group	15,000	20,000	35,000	28,000	37,000	65,000	1,500,000	700,000	2,200,000
3	Landing Gear Group	2,000	4,000	6,000	2,000	4,000	6,000	200,000	50,000	250,000
4	Power Plant Group							400,000	600,000	1,000,000
5	Fixed Equipment Group							100,000	-	100,000
6	Extra Equipment Group							20,000	-	20,000
7	Nacelle Group	500	500	1,000	500	500	1,000	50,000	30,000	80,000
8	Final Assembly							15,000	50,000	65,000
	Totals	$28,500	$31,500	$60,000	$52,500	$55,000	$107,500	$2,985,000	$1,565,000	$4,550,000

Figure 82. Report of Total Actual Cost Compared with Estimated Costs

COST PER AIRPLANE FABRICATED

Order A31—Quantity of 50

Work Started June 20, 19—, Completed December 13, 19—

	Cost per Airplane				Estimated Cost
	Material	Labor	Overhead	Total	
Wing Group	$	$	$	$	$
A31-03 Lower Wings					
05 Ailerons					
07 Flaps					
Total					
Tail Group					
A31-11 Stabilizer					
12 Fin					
13 Elevator					
14 Rudder					
Total					
Body Group					
A31-21 Fuselage					
26 Floor					
28 Baggage Compartment					
Total					
Landing Gear Group					
A31-31 Main Gear					
32 Shock Struts					
33 Wheels, Tires and Tubes					
34 Tail Wheel Gear					
Total					
Power Plant Group					
A31-41 Engine Accessories					
42 Fuel System					
43 Oil System					
45 Exhaust System					
47 Propellers					
Total					
Fixed Equipment					
A31-51 Instruments					
53 Air Controls					
54 Stabilizer Controls					
56 Seats					
Total					
Extra Equipment					
A31-61 Radio					
63 Photographic Equipment					
67 Oxygen Equipment					
Total					
Nacelle Group					
A31-71 Engine Mount					
72 Engine Cowling					
73 Nacelle Structure					
Total					
Total Fabricating Cost per Airplane					

Figure 83. Actual and Estimated Unit Production Cost Analysis

shows the current, cumulative, and total estimated costs for material and labor. In Figure 83 the total actual costs for material, labor, and manufacturing overhead are compared with the total estimated costs for the completed order.

Advantages and Disadvantages of the Job Order Cost System. The advantages of job order costing may be summarized as:

1. Ability to detect which jobs are profitable, which unprofitable.
2. Use of job costs as a basis for estimating similar work in the future.
3. Use of job costs as a basis for controlling efficiency of operations. This is done by comparing actual costs against estimates which are prepared when making quotations to a customer.
4. Use of job costs on government contracts and other contracts where cost determines selling price. In such contracts, the manufacturer is allowed to charge cost plus a fixed fee or cost plus a reasonable profit. Such costs must be kept on a specific order basis.

However, it should be noted that job cost information as a basis for estimating similar work in the future can be used only within limits. There may be considerable discrepancies in the costs of production because of differences in time between the completed order and the one being estimated, and also differences in the size of the order. It is possible of course that, when compiled in useful form, job order costs may furnish serviceable data for estimating purposes.

In general, the cost of operating a job order system is considerable. The volume of detail which must be kept is large and the question often arises as to the justification for the heavy clerical expense necessary to find out what an order actually costs.

QUESTIONS

1. *a*) List the steps in accounting for cost under a job order cost system using actual manufacturing overhead expense.
   b) Indicate the changes in (*a*) where predetermined overhead rates are employed.

2. In the Peterson Manufacturing Company, careful time records are kept for engineering costs in connection with designing and preparing specifications and blueprints for each job. Although the cost of the engineering function is generally treated as a service department cost, the management of the company seeks your advice on charging these engineering costs as direct job costs. Discuss the procedural changes necessary to charging engineering cost as a direct job cost.

3. The Allan Manufacturing Company manufactures lens assemblies—consisting of lenses and frames, to customer order. Lenses are manufactured on order for stock and are considered finished parts. Sub-

sequently, these parts are assembled to customer order and specification. Outline a system of accounting for parts manufactured and for their issue into assembly orders so that a production order for assembled units will clearly show details for labor, material, and manufacturing overhead.

4. The task of ascertaining the value of work in process is much simpler in a job order cost system than in a process cost system. Do you agree? Explain.
5. Explain the treatment of defective work in a job order cost system.
6. How would you prove the accuracy of the balances in the finished goods and work in process accounts in a job order cost system?
7. Units costs derived from job cost records are much closer to "true" costs than unit costs derived from process costs records. Do you agree? Explain.
8. Differentiate between a production order, a bill of materials, and a job cost sheet.
9. Explain the function of a
   a) Direct materials used account
   b) Finished goods account when goods are shipped directly from the factory floor.
10. *a*) Explain the treatment of the cost of repairing goods discovered to be defective before being shipped.
    b) Indicate the effect of this treatment on (1) the inventory of work in process at the end of the period, (2) the cost of goods produced, and (3) the net profit for the period.
11. Discuss briefly the relative merits of charging overtime premiums to individual production orders or including them in the departmental overhead.
12. A company operating a machine shop has undertaken to produce, as a subcontractor under a prime contract with a government agency, certain parts on a cost-plus-a-fixed-fee basis. The hours of operation are about evenly divided between the above contract and the regular business of the company.

    Each day the work required for the regular company business is first completed. The remainder of the day, with whatever overtime is necessary, is given over to production under the contract. During the contract period, overtime hours represented a substantial proportion of the total hours worked. Under an agreement with the employees, time and a half was paid for all hours over eight, worked each day.

    On job sheets were recorded the actual cost of materials consumed and direct labor, including any overtime premium paid. Burden was applied on the basis of the labor cost so recorded, and the sheets were adjusted each month to eliminate any balance in the burden variance account.

Upon completion of the contract, you are requested by the company to certify to its cost determination.

Explain or briefly outline the following:

a) Your objections to any cost accounting principle applied
b) Its effect in the client's statements
c) Procedure you would follow in making a revised cost determination

13. The H Manufacturing Company is engaged in manufacturing items to fill specific orders received from its customers. While at any given time it may have substantial inventories of work in process and finished goods, all such amounts are assignable to firm sales orders which it has received.

The company's operations, including the administrative and sales functions, are completely departmentalized. Its cost system is on a job order basis. Direct materials and direct labor are identified with jobs by the use of material issue tickets and daily time cards. Overhead costs are accumulated for each factory service, administrative, and selling department. These overhead costs, including administrative and selling expenses, are then allocated to productive departments and an overhead rate computed for each productive department. This rate is used to apply overhead to jobs on the basis of direct labor hours. The result is that all costs and expenses incurred during any month are charged to the work in process accounts for the jobs.

a) Compare this system, as it affects inventory valuation, with the usual system for manufacturing businesses.
b) Criticize the system as it affects inventory valuation and income determination.
c) State any justification which you see for the use of the H Company's system.

Chapter 15

ESTIMATED COSTS

Predetermined Costs. It is often necessary or desirable to know what goods will probably cost before they are made. Many business decisions are based upon such advance estimates of cost. The most common use is in connection with price quotations. Thus cost estimates are generally made when pricing articles built to customers' specifications (e.g., locomotives, ships, buildings), or new products for which manufacturing experience and hence recorded costs are lacking, or goods ordered in special quantities. Estimates are also employed in determining the probable effect on costs if some proposed change in equipment, material, or manufacturing method is contemplated. They also help to determine what it will cost to produce a proposed new product, when the cost must be known in order to decide whether the product can be made and sold on a profitable basis. Finally estimates may be used in setting goals toward which to work in controlling costs. Used for these purposes, estimated costs are in many ways similar to the standard costs discussed in the next chapter. They represent an attempt to predetermine all elements of product cost.

Methods of Cost Determination. Costs of manufactured products or of services may be determined through the use of continuous records or through cost approximations. The latter may take the form of cost finding or of cost estimating.

Continuous cost records represent a formal cost accounting procedure and constitute part of the double-entry system. They incorporate systematic routines which through the use of subsidiary ledgers subclassify costs in any desired degree of detail. The main disadvantage of formal cost accounting is its expense. A considerable saving in accounting costs can often be effected by substituting occasional test checks of product costs for continuous and repetitive calculation of unit costs. This sort of cost analysis limits accounting activities to the accumulation of departmental figures for budget comparisons, for cost control, and for pricing, and leaves unit product costs to be established at intervals by informal methods. Although the techniques employed in tracing costs in such circumstances are based upon principles similar to those applied in formal cost accounting, the results are less accurate.

COST FINDING. Cost finding may be defined as *ex post facto* determination of the cost of producing goods or performing services, by the use of informal procedures in statistical or memorandum form, i.e., without carrying on the regular processes of cost accounting on a continuous or formal basis. The distinction between cost finding and cost accounting is not always an easy one to make. However, when formal techniques of subsidiary ledger classification and perpetual inventory control are abridged, or whenever cost analysis is carried on in a noncontinuous or nonrepetitive fashion, the resulting cost calculations are referred to as cost finding rather than as cost accounting.

COST ESTIMATING. Cost estimating represents the process of compiling the cost of articles to be made. In compiling the estimated cost, use may be made of actual cost figures, past or present, and of facts concerning the available plant and equipment, labor and overhead rates, present and future market prices of material, and knowledge of the processes to be performed.

Estimated Cost Systems. Where the estimates are incorporated in the books and the books themselves are made to show differences between actual and estimated costs, cost accounting of the estimated cost type is said to exist. Cost finding deals with historical data in connection with activities which have already taken place. Cost estimating, on the other hand, looks to the future since it represents a forecast of probable costs. Thus, it is seen that the processes of cost finding and cost estimating do not differ materially; hence the technique of cost finding is not separately discussed in this chapter. Cost estimating, however, has a function beyond the necessity of predicting a cost. Often cost estimates become adjuncts to job order or process costs, particularly if these are based on historical costs. In this way, cost estimates can be made to provide bases of comparison that are otherwise lacking in historical cost systems.

Cost estimating, especially in a large plant, is usually performed by specially trained personnel called estimators. They must possess on the technical side a thorough knowledge of the engineering basis of the product whose cost is to be estimated. This involves a knowledge of the kinds and quantities of material required in its manufacture, labor operations, tool costs, and machine requirements. On the accounting side the estimator must be thoroughly familiar with the official account classifications, with the nature and behavior of the expense accounts, and the bases upon which the overhead costs are apportioned.

Preparing Cost Estimates

General Procedure. Although different situations require some variation in method, there should be a general order of procedure for making cost estimates applicable to most cases. The content of cost estimates differs as the purpose of the estimate varies. Also, different situations require varying degrees of accuracy of computations. The preparation of a cost estimate should be based on:

1. Complete drawings and specifications of the product
2. The quantity to be manufactured
3. Raw materials and purchased parts required and their expected costs
4. List of labor and machine operations to be performed, operation times, and rates
5. Overhead applicable to product
6. Complete data concerning equipment available, its capacity, and its operating costs

Previous Estimates. The fundamental basis for all estimating is that no action or proposal is ever entirely new in all respects; there are always some elements in any new product or procedure which are repetitions or modifications of previous operations or activities. For instance, a new model motor car is similar to previous models in many respects. A material amount of time may be saved in making use of previously estimated items or parts, which are component parts of the product on which an estimated cost is desired. Even specialized mechanical products of entirely new design are fabricated by means of basic operations such as casting, forging, cutting, drilling, and grinding. Even though a casting of a certain size and shape has never been manufactured, a knowledge of cost experience with other kinds and sizes of castings yields a useful basis for predicting what the new type will cost. Hence, a large part of all cost estimating consists of accumulating and interpreting data concerning costs of operations which are either identical, or at least similar, to the ones proposed. Making proper adjustments or allowances for difference between what has been done and what is to be done yields a reasonable forecast of the cost of the proposed venture.

Previous estimates are also useful in comparing and checking completed costs of the product as a whole, due consideration having been given to changes in labor rates, material costs, plant equipment and layout. If comparable accounting costs are available, a good idea of estimating errors to be avoided can usually be had. Often, the only means of safeguarding the completeness and accuracy of a cost estimate is to make sure that mistakes or omissions in previous estimates are not repeated.

Previous Actual Cost Records. Cost records are the actual records of the costs of products already made. They may contain a record of the article to be estimated or re-estimated, or the cost of similar products. They may also contain the cost of various units or component parts which can be used in the estimate.

Much specific information is compiled and preserved on cost sheets with respect to particular jobs, processes, and classes of product, and operations performed in making them. Then, too, accounting records compile and preserve data concerning departmental activities and corresponding costs. Frequently, these records can be employed to estimate costs of similar products by mere correction for price changes in the cost factors.

Time Available for Production. By time available is meant the time for the production of the specified quantities of product to be made. If a customer desires, for example, to purchase a product, one unit to be delivered each day for a month, while another customer may wish deliveries to be made two per day over the following 15 days, the estimated cost may be materially affected. It may be necessary, on account of the limited time for production of the articles, to pay bonuses, premiums, or overtime. The cost of building, machinery, tools, and equipment may be affected by time as, in order to produce a large quantity within the time specified, additional or new buildings, machinery, tools, and equipment may become necessary.

Estimates in Terms of Unit Costs. Many cost estimates are made by establishing certain kinds of "estimating units," i.e., setting up some basis for relating costs of a proposed venture to past experience. For example, to secure rough estimates of the costs of building construction, floor area or cubic content bases are often employed. These methods rely upon an assumed relationship between area or volume of a building and its cost. Thus, a residential building may be calculated to contain approximately 31,320 cubic feet, by referring to dimensions on the architect's drawings. For buildings of similar type and quality, past experience may indicate a "cube cost" of $1. The cost of the house would thus be estimated at $31,320.

The purpose of such analysis is to make possible comparison between estimates covering different programs or plans. The choice of a cost unit is dictated by convention or custom. In the case of construction estimates, floor area and cubic content are the usual cost units. Sometimes, however, construction costs are expressed "per room" or "per apartment." Power plant construction costs may be expressed in terms of horsepower or kilowatt capacity units. Castings, forgings, and other parts may be expressed per pound or per piece.

Another use of unit costs of this character is in the nature of a rough check on the completeness and accuracy of the detailed estimate. Despite the fact that estimates made from such unit costs alone are usually not reliable, a comparison of unit costs calculated from detailed data with "rule-of-thumb" unit costs may serve to indicate large discrepancies. Unit cost checks can be worked out with respect to specific products or processes, and may serve to avoid mistakes of omission of items in the detailed process of estimating.

Analysis of Project. Cost may be estimated by analyzing the project in one or more ways mentioned below:

1. Separation into parts
2. Separation by operations
3. Separation by cost elements

Estimating manufacturing costs is usually facilitated and made more precise by analysis of the product into its component parts before estimating units are chosen. For instance, if the product for which costs are to be estimated is an electric table stove, estimating is facilitated by considering separately the wire heating element, porcelain base, chrome-plated frame, connectors, plug, and cord. The best illustration may be obtained from the construction industry. Thus building estimates are usually found to be more precise if the problem is approached by estimating the various parts of construction separately. If costs of excavation, walls, floors, roof, etc., are estimated separately, the points of similarity and difference between the proposed venture and past experience can be more easily allowed for, and these individual estimates when combined yield a more trustworthy total cost figure.

Another basis of analysis of the product or project often employed in estimating is that of operations or processes necessary to production. This method is used along with or in addition to the separation of parts referred to above. For instance, making a certain part for a mechanical device may involve casting, drilling, milling, grinding, and polishing. Recognition of these specific operations facilitates estimating labor costs and also increases the precision of the estimate.

If the operations required to produce a given product or part can be definitely stated, it is an easy matter to break down each operation into its respective requirements of direct labor and direct materials. Overhead may be estimated by means similar to those employed in formal cost accounting.

Estimating Costs of Mechanical Products. The principal divisions, besides the estimate for material, labor, and overhead, into which the estimating of the cost of mechanical products may be subdivided are:

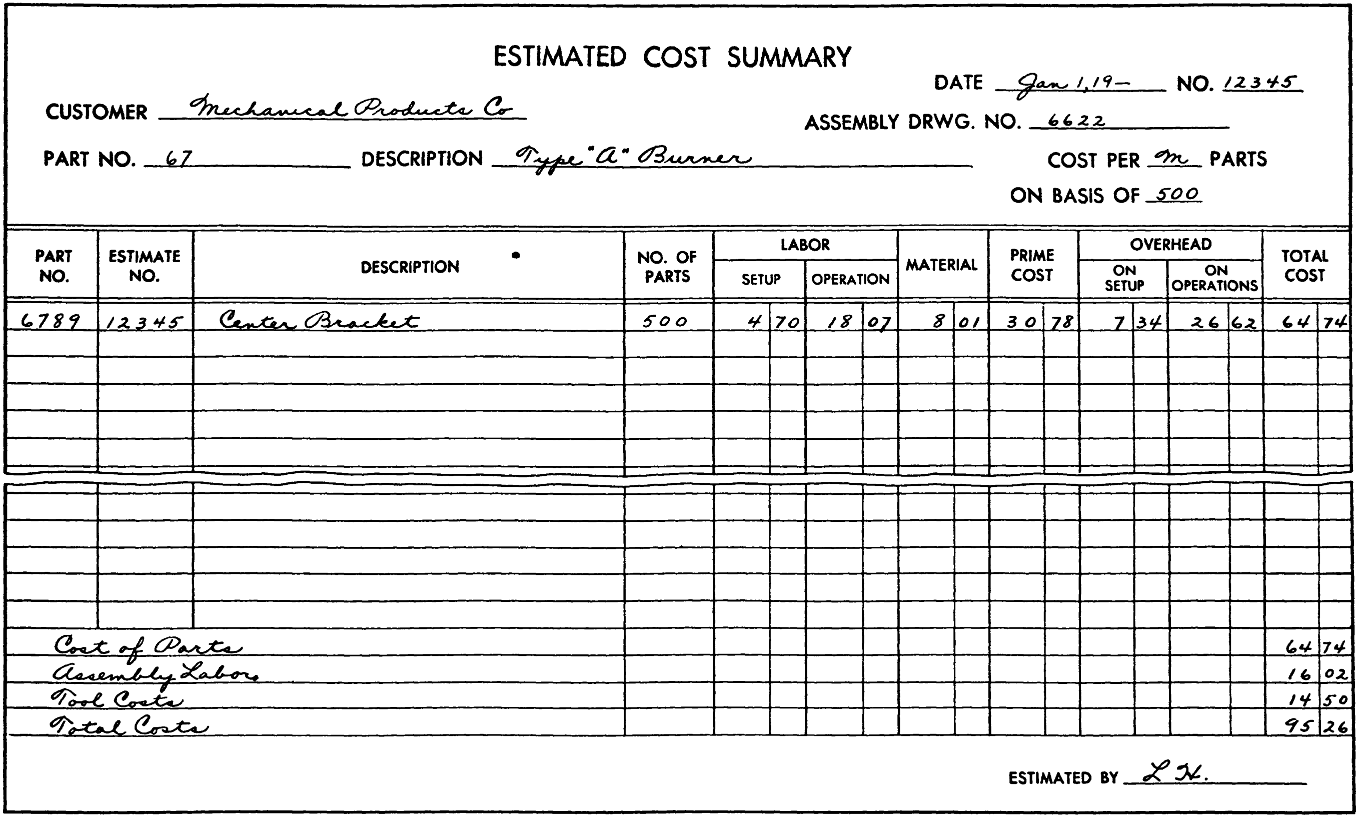
1. Design time
2. Design data
3. Drafting time
4. Use of building and machinery
5. Patterns, jigs, and special tools
6. Experimental work

The basic information for all of these items comes in the first instance from the engineering department. Time spent in designing is usually charged at standard rates per hour as set by the cost department. The same is true of time spent on design data and drafting time. Included under the last two items are such things as product specifications, preliminary sketches, and bills of materials. The cost estimate is also affected by the routing and operations of the product; i.e., which buildings, machines, tools, dies, jigs, and patterns are to be used. Many jobs require tools which in turn may have to be specially designed. Finally, much experimental work may have to be done, before the product can go into regular production.

Estimating Quantity and Prices. A list is compiled showing specific operations on particular parts. On a simple job these consist only of a schedule of materials required, and a sheet or sheets showing the operations to be performed, space being left for time estimates, labor rates, overhead rates or percentages, and extensions; these may even be combined in a single form. Whatever procedure is used the estimate must take into account the specific quantity to be produced, and the specific operating conditions under which it is to be produced. The quotation sheet should therefore indicate the size of the order contemplated in the prices quoted (Figure 84).

Cost Estimate Sheet. The estimates are entered or, if many calculations have been made, summarized on cost estimate sheets (Figure 84). If an order is received, the estimate sheet forms the basis for control of manufacturing cost since it tells what should be spent to make the goods. When an estimating cost system is in use, it also provides the unit cost at which to price the goods on hand at inventory date.

Cost estimate sheets commonly provide space for listing the materials that are to be used, the quantities of each, and their cost. If necessary, allowances for scrap, expected spoilage, and rework costs are included. Labor operations to be performed are listed and hours needed are extended at current or expected wage rates to obtain the estimated labor cost. In order to complete the manufacturing cost, overhead applicable



ESTIMATED COST SUMMARY

DATE Jan 1, 19— NO. 12345

CUSTOMER Mechanical Products Co

ASSEMBLY DRWG. NO. 6622

PART NO. 67

DESCRIPTION Type "A" Burner

COST PER M PARTS

ON BASIS OF 500

PART NO.	ESTIMATE NO.	DESCRIPTION	NO. OF PARTS	LABOR		MATERIAL	PRIME COST	OVERHEAD		TOTAL COST
				SETUP	OPERATION			ON SETUP	ON OPERATIONS	
6789	12345	Center Bracket	500	4 70	18 07	8 01	30 78	7 34	26 62	64 74
Cost of Parts										64 74
Assembly Labor										16 02
Tool Costs										14 50
Total Costs										95 26

ESTIMATED BY L. H.

FIGURE 84. Estimated Cost Summary

to the order is then added to determine the total manufacturing cost of the order and the cost per unit of product. When the estimate is to be used for pricing, selling and administrative costs applicable are usually added to manufacturing cost.

It is desirable to compare the actual costs of making the goods with the estimated costs. This comparison is made and differences are analyzed to determine how accurately the estimate was made in order to check upon the person or department preparing estimates and also to find what corrections should be made in the estimates if another order for the same thing should be received. However, differences between estimates and actual costs may be the result of inefficiency or mistakes in production rather than inaccurate estimates. Where this occurs the estimate should not be revised.

Estimates of cost often provide a good basis for cost control. The cost estimate sheet together with the underlying drawings, lists of material, and labor operations tell what material, labor, and services should be used to make the product. If these estimate sheets are put into the hands of the foreman when the work on the order starts, he can be held responsible for meeting these costs. A comparison between actual cost and estimated cost then provides a measure of the efficiency with which the work is being done.

Estimating Cost Systems

Definition. As stated earlier in this chapter, an estimating cost system is one in which estimated unit costs of products are used to cost inventories of work in process and finished goods in the accounts. Such use of cost estimates is essentially a short-cut method designed to obtain some of the benefits of cost accounting with a minimum of expense for record keeping.

The shoe and clothing industries furnish excellent examples of plants using estimated costs. In both of these industries the element of style has become predominant. It is necessary to make up samples, quote selling prices, and take orders far ahead of the actual manufacturing. Manufacturing operations are not started until orders have come in from the trade; and to secure the orders it is necessary to quote a definite selling price. In turn this requires a careful estimating of costs on the basis of the material and labor markets, allowing for such fluctuations in each as may reasonably be expected during the period of manufacture. In this respect both the shoe and clothing manufacturers are in a position to make accurate estimates. Generally speaking, the labor they employ is strongly organized, and contracts are in force fixing rates for work and conditions of employment for definite periods of time.

Another fertile field for estimating costs lies in construction work of all kinds, such as shipyards, building construction, and construction of bridges and tunnels. Generally, there is no mass production or style element involved, each job being unique in the sense that there will never be another exactly like it. Though the plans and specifications may call for two houses exactly alike, there may be differences in the grading of the land and the soil strata, making different foundations necessary and hence causing differences in costs. However, the construction industry shares with clothing and shoes the necessity for determining selling prices beforehand. Work of this kind is commonly secured by the contractor on the basis of competitive bids submitted and the contractor who is able to make the most accurate estimate is in a position to secure work that will yield him a profit or to reject work that the estimates show to be unprofitable.

Estimating Cost Procedure. Predetermined overhead rates are employed in job order costing and process costing in order to secure costs promptly when a job or process is completed. Estimating cost accounting simply extends this method to the use of predetermined costs for direct material and direct labor as well as for overhead. On the basis of the best information available, costs are established for material, labor, and overhead per unit of output. These estimated costs are incorporated in the accounts and the books themselves are made to show differences between actual and estimated costs.

Estimating cost plans vary in the manner in which these variances between actual and estimated costs are determined. There are three basic ways in which the differences may be determined; viz., comparison of actual and estimated costs (1) by total costs, (2) by elements of cost, or (3) by departments. Combinations such as comparison by elements for each department are also used. While possible to extend the process of comparison to any number of products or departments by elements of cost, it is not practical to do so because the bookkeeping becomes cumbersome and costly in clerical work. If costs of numerous products, jobs, or processes are desired, a process or job order cost system is less costly to operate. Usually it is even better to use a standard cost system, for this plan of accounting provides all the detail necessary with a minimum of clerical work.

Essentials of Estimating Systems. The minimum requirements in the way of forms used in an estimating system are: (1) a schedule of estimated costs, (2) an inventory schedule, (3) an analysis of the cost of sales.

The schedule of estimated costs is usually prepared by lines of product. Where the lines are numerous and estimated and actual costs are desired in considerable detail, separate schedules are prepared for each line. An excellent example of this is furnished by the shoe industry (Figure 85). The face of the form shows all material charges, the reverse side all direct labor charges, manufacturing overhead, selling expense, desired profit, and selling price. The labor operations, due to their large number and also the manufacturing overhead, are shown in detail on a so-called cost estimate sheet (Figure 86). These are then summarized on the schedule of estimated costs (Figure 85).

The inventory schedule does not necessarily require the taking of a physical inventory. Raw material and finished goods stock ledgers can be maintained to furnish continuous balances. The balance of work in process inventory can be determined by comparing the quantities charged to the factory with the finished production turned over by the factory to the finished goods stockroom. For instance, the stores requisitions of a garment factory for a given month might show 3,000 yards of cloth had been issued to the cutting room. The schedule of estimated costs is then consulted. This schedule shows the yardage required to make one garment. Assuming three yards to a garment, the equivalent of 1,000 garments have been put into process. Next the factory's production report shows that 800 fininshed garments have been placed in stock. It must be evident, therefore, that 200 garments are still in process. All that need be done is to estimate the stage of completion, which is then listed on the inventory schedule (Figure 87). The inventory is then costed on the basis of the figures contained in the schedule of estimated costs, taking into consideration, of course, the stage of completion. The resulting figure is the work in process inventory which is recorded on the books.

When a sale is made it is necessary to determine the cost of sales at the estimated price. Since one sale may cover a wide variety of styles, it is customary to analyze the sales and then summarize them on a cost of sales summary (Figure 88) from which the necessary entries are made.

Disposition of Variances. The balance in the Cost Variation account, representing as it does the difference between estimated cost and actual cost, is disposed of in closing the books by one of the following methods:

1. Transferring the variance to Cost of Sales or Profit and Loss
2. Deferring the variance
3. Spreading the variance over the goods completed during the period

UNIT . . . . . DATE . . . . SHOE NO. . . . . .

DESCRIPTION

DESCRIPTION					
Upper Stock:					
Stock					
Lace Stay					
Outside Back-Stay					
Straps					
Bottom Stock (inc. labor):					
Outsole I. Gdc.					
Tap or Middle Sole					
Insole					
Welt					
Counter					
Heel					
Top Lift					
Box Toe					
Linings and Trimmings:					
Lining					
Vamp and Top Doubling					
Side Lining					
Inside Heel Stay					
Eye. or Butt. Facing					
Top Facing					
Fly or Tongue Lining					
Hook or Button Stay					
Findings:					
Upper Thread or Silk					
Hooks					
Eyelets					
Laces, Butt. or Buck.					
Covers					
Bottom. Room Thread					
Shanks and Filling					
Wire and Nails					
Heel Pads					
Leather Repairers					
Cases					
Cartons and Labels					

FIGURE 85*a*. Summary of Cost Estimate (*face*)

TRANSFERRING VARIANCE TO COST OF SALES OR PROFIT AND LOSS. When the variance between estimated and actual costs is insignificant in amount, it is usually preferable to follow this method since it avoids adjusting the inventory accounts. Thus it is a practical short cut that can be used where the effect on inventories and cost of sales is too small to be important. This method may also be desirable when variances

					Labor:
					Cutting
					Fitting
					Lasting
					Bottoming
					Edge Room
					Finishing
					Treeing and Dressing
					Repairing
					Packing and Inspecting
					Shipping
					Cripple Allowance
					Royalty
					Manufacturing Overhead
					Total Manufacturing Cost
					Selling Expense %
					Total Cost
					Profit
					Net Selling Price
					Sales Discount %
					Gross Selling Price

FIGURE 85*b*. Summary of Cost Estimate (*reverse*)

arise for reasons beyond the control of management as, for example, during a period of low sales volume when the variance might represent underabsorbed overhead.

DEFERRING VARIANCE. Variances may be deferred by setting up a Variance Reserve on the assumption that it will eventually be offset by

COST ESTIMATE SHEET

Unit Pr. Class WELTS Date .... Style No. . . .

RUN						RUN					
1. Cutting Uppers						45. Stitch. Tong. Linings					
2.						46. Closing Side Linings					
3. Cutting Quart. Lin						47. Closing Toe Linings					
4. Cutting Vamp Lin.						48 Seaming Side Linings					
5. Cutting Back Straps						49. Cement. for Fitting					
6. Cutting Trim. & Fac.						50. Cement. Quarters					
7. Cutting Tong. Linings						51. Fitting					
8. Ctg. S'k. Lin or H.P.						52. Stitching Tops					
9. Ctg. Perf. or Cut-outs						53. Stitching Sides					
10. Ctg. Doub. or Toe Lin.						54. Stitching All Around					
11. Cutting Reinforcings						55. Edging					
12. Cutting Pockets						56. Stitching Eyelet Row					
13.						57. Fancy Stitching					
14. Stamping Uppers						58. Stitching Cutouts					
15. Stamping Linings						59. Stitching Panels					
16. Skiving Vamps & Tips						60. Stitching Pockets					
17. Skiv. Quar. Fox Strps.						61. Eyeltg. or E. with Hks					
18. Skiving Folding						62. Perforating Tips					
19. Skiving Bevelling						63. Perforat. Eyelet Row					
20. Burnish Edging						64. Perf. Quart., Foxings					
21. Mark. Tips & Quarts.						65. Perforat. Vamps, Sides					
22. Crimp Uppers & Lin.						66. Closing Foxings					
23. Assembling .						67. Seaming Foxings					
24.						68. Stitching Foxings					
25. Closing Backs						69. Perforation Stitching					
26. Seaming Backs						70. Stitching Tips					
27. Stitching Back Straps						71. Stitching Boxtoes					
28. Cementing Back Straps						72. Stitching Counters					
29. Folding Back Straps						73. Stitching Tongues					
30. Rubbing .						74. Stitch. Stays, Straps					
31. Stitching Pieces .						75. Stitching Buckles					
32. Closing Fronts						76. Binding					
33. Seaming Fronts .						77. Closing Vamps .					
34. Closing Tips						78. Seaming Vamps					
35. Reinf. Vamps, Quart.						79. Matching Vamps					
36 Cement. for Folding						80. Assembling Vamps					
37. Folding Vamps & Tips						81. Assembling Quarters					
38. Folding Quart & Fox						82. Vamping					
39. Folding Stays						83. 2d Row Stitch on Qt.					
40. Stitching 1st Row						84. 2d Row Stitch. on Vps					
41. Stitch. Saddles to Qt.						85. Barring					
42. Pasting Inlays						86. Buttonholing					
43. Opening Linings						87. Lacing					
44. Making Linings						88. Sewing on Buttons					

FIGURE 86*a*. Detailed Cost Estimate Sheet for Labor and Manufacturing Overhead (*face*)

an opposite variance. Variances in cost due to different numbers of working days in a month or seasonal fluctuations in activity may justify use of this method. However, it is generally used only for monthly or quarterly closings, one of the other methods being used at the year's end.

SPREADING VARIANCE OVER GOODS COMPLETED DURING PERIOD. This method is based upon the assumption that estimated costs have been in error and should be corrected when actual costs become known. The

Unit . . . Pr. Style No. . . . . .

RUN						RUN						
89. Buttoning or Buckl'g						128. Scouring Heels No. 1						
90. Stain'g or Ink'g Edgs.						129. Breasting Heels						
91. Sizing and Sorting						130. Scour. Heel Breasts						
92. Trimm'g & Exam'g						131. Doping Heels						
93.						132. Trimm'g Joints No. 2						
94.						133. Trimming Edges						
95. Pick Lasts & Assem.						134. Scouring Heels No. 2						
96. Tacking Insoles						135. Setting Edges .						
97. Trim. Insole Seats .						136. Inking Heels .						
98. Assembling . . .						137. Burnishing Heels						
99. Pulling Over						138. Cleaning Heels .						
100. Side Lasting .						139. Buffing Foreparts						
101. No. 5 Lasting						140. Naumkeag. Forepts.						
102. Stapling Uppers						141. Buffing Toplifts . .						
103 Trimming Toes						142. Bleaching .						
104 Pulling Tacks No. 1 .						143. Staining Bottoms						
105. Inseaming						144. Waxing Bottoms						
106 Pulling Toe Wire						145. Wheeling . .						
107. Trimming Inseaming						146. Polishing Bottoms .						
108. Pulling Tacks No. 2						147. Finishing & Buffing						
109. Trimm'g Joints No. 1						148. Cutting Tacks						
110. Beating Welting						149. Sock Lining						
111. Tacking Shanks						150. Treeing & Cleaning						
112. Filling Bottoms .						151. Cleaning Linings						
113. Cementing Bottoms						152. Dressing						
114. Laying Soles						153. Buttoning or Lacing						
115. Rough Rounding						154. Brushing .						
116. Opening Channels						155. Trimming						
117 Goodyear Stitching						156. Stamping Bottoms						
118. Cementing Channels						157. Embossing . .						
119. Laying Channels						158. Stamping Cartons						
120. Leveling .						159. Packing						
121. Separating Stitches						160.						
122. Seat Nailing						161.						
123. Trimming Heel Seats						162.						
124. Heel.—Leath Heels						163.						
125. Heel.—Rubber Heels						164.						
126. Slugging						165.						
127. Trimming Heels												
Cutting Overhead %						Total Cutting Labor . . .						
Fitting Overhead . %						Total Fitting Labor . . .						
Making Overhead %						Total Making Labor . .						
Fin. & Pack. Overhead %						Total Fin. & Pack. Labor .						

FIGURE 86*b*. Detailed Cost Estimate Sheet for Labor and Manufacturing Overhead (*reverse*)

apportionment of the variance may be accomplished on the basis of number of units, either physical or equivalent units, or on the basis of cost values. In any event, work in process and finished goods inventories are by this means converted to actual cost.

When spreading the variance over units completed during the period, the applicable portion must be debited or credited to Work in Process, Finished Goods, and Cost of Sales. The variance is divided by the number of units produced to obtain the amount of the variance applicable

INVENTORY SCHEDULE OF WORK IN PROCESS

Department Cutting

Date November 30, 19—

Article	Quantity	Total	Material			Labor			Manufacturing Overhead		
			Unit Price	Stage of Completion	Total	Unit Price	Stage of Completion	Total	Unit Price	Stage of Completion	Total
P41	200	$ 600.00	$1.50	100%	$300.00	$1.00	60%	$120.00	$1.50	60%	$180.00
BT16	400	1,360.80	2.25	100%	900.00	1.20	40%	192.00	1.68	40%	268.80

FIGURE 87. Inventory Schedule of Work in Process

SUMMARY OF COST OF GOODS SOLD

Month of November, 19—

Article	Quantity Sold	Material		Labor		Manufacturing Overhead		Total	
		Unit Cost	Total	Unit Cost	Total	Unit Cost	Total	Unit Cost	Total
BT16	300	$2.25	$ 675.00	$1.20	$ 360.00	$1.68	$ 504.00	$5.13	$1,539.00
F1409	1,000	1.80	1,800.00	1.40	1,400.00	2.00	2,000.00	5.20	5,200.00

FIGURE 88. Summary of Cost of Goods Sold

to each unit. For example, assume production to have been 10,000 units of which 1,000 remain in process, 3,000 are on hand finished, and 6,000 were sold; also assume the total variance to be $600 (debit), then the unit variance is $.06 (i.e., $600 ÷ 10,000). The various accounts are then debited with the following amounts:

Work in Process	(1,000 × $0.06) =	$ 60
Finished Goods	(3,000 × 0.06) =	180
Cost of Sales	(6,000 × 0.06) =	360
	10,000	$600

As an alternative, the variance may be distributed on the basis of cost rather than number of units.

Accounting Procedure. Following is a summary of the accounting procedure:

1. Open the necessary cost controlling accounts, i.e., Stores, Work in Process, and Finished Goods, the number of work in process accounts depending upon the degree of details of the estimates desired. If the estimated costs are to be computed by totals, only a single work in process account suffices. If computation is to take place by elements of cost, then separate work in process accounts are opened for each element. The subdivision can of course be carried further, viz., by products, elements, and departments; but, as already pointed out, this makes the system unwieldy.
2. Stores account is handled in the usual manner, being debited and credited with actual costs of items received and issued.
3. Work in Process is debited for the actual cost of material, labor, and overhead. It is credited for finished production at *estimated costs.*
4. The inventory of work in process is determined as to quantity by comparing the material issued to the factory with the summary of completed production, or by a physical inventory.
5. The inventory of work in process is then priced at estimated costs taking into consideration the stage of completion. The inventory is recorded on the books by means of a journal entry.
6. The balance in Work in Process account is closed out to a Cost Adjustment or Cost Variation account.
7. Finished Goods account is debited and credited at estimated costs.
8. Cost of Sales is debited at estimated costs.
9. After the difference between actual cost and estimated cost has been determined, the estimated costs are corrected and the corrected estimates used thereafter.

Illustration of Estimating Cost Procedure

The following problem and solution illustrate operation of an estimating cost plan where comparison of estimated and actual costs is by elements of cost.

PROBLEM. The Dees & Doze Co., Inc. uses an estimating cost system. It manufactures Epsichol for which the estimated cost per barrel by elements is:

Direct Materials (added at beginning of process)	$2.50
Direct Labor	3.60
Manufacturing Overhead	2.30
Total	$8.40

The actual costs for August, 19—, taken from the usual sources of information, are:

Direct materials $30,240; direct labor $43,680; and manufacturing overhead $27,360.

The production report shows that 11,000 bbls. were manufactured and sent to the finished warehouse in August.

During August, 12,000 bbls. were put into process.

On August 1, there were 600 bbls. in work in process averaging 62% completed, and 1,000 bbls. of finished goods, each valued at estimated cost.

On August 1, the cost value of raw materials and supplies was $25,000.

On August 31, the work in process averaged 83% completed.

During August, 9,500 bbls. of Epsichol were sold for $12 per bbl., and raw materials and supplies were purchased for $14,728.

Required:

1. Submit all journal entries.
2. Submit the necessary cost accounts to show the estimated costs of the inventories on September 1, 19—.
3. Prepare a schedule of the variance distribution on the basis of effective production.

Note: In all calculations use the first-in first-out method of pricing goods.

Solution:

DEES & DOZE CO., INC.

SUMMARY JOURNAL ENTRIES

August 31, 19—

(1)

Raw Materials	$14,728.00	
Vouchers Payable		$14,728.00
August purchases (actual).		

(2)

Material in Process	$30,240.00	
Raw Materials		$30,240.00

Material consumption (actual).

(3)

Labor in Process	$43,680.00	
Payroll Accrued		$43,680.00

Actual direct labor cost.

(4)

Manufacturing Overhead in Process	$27,360.00	
Sundry Accounts		$27,360.00

Actual Manufacturing Overhead.

(5)

Finished Goods (11,000 × $8.40)	$92,400.00	
Material in Process (11,000 × $2.50)		$27,500.00
Labor in Process (11,000 × $3.60)		39,600.00
Manufacturing Overhead in Process (11,000 × $2.30)		25,300.00

For completed production at *estimated* cost.

(6)

Material in Process (New) (1,600 × $2.50)	$ 4,000.00	
Labor in Process (New) (1,600 × 83% × $3.60)	4,780.00	
Manufacturing Overhead in Process (New) (1,600 × 83% × $2.30)	3,054.40	
Material in Process (Old)		$ 4,000.00
Labor in Process (Old)		4,780.80
Manufacturing Overhead in Process (Old)		3,054.40

To record closing inventories at estimated cost.

(7)

Cost of Sales (9,500 × $8.40)	$79,800.00	
Finished Goods (Old)		$79,800.00

August sales.

(8)

Manufacturing Overhead in Process (Old)	$ 138.80	
Variance from Cost Estimates	739.60	
Material in Process (Old)		$ 240 00
Labor in Process (Old)		638.40

To close cost variances.

(9)

Material in Process (New)	$ 32.00	
Labor in Process (New)	70.91	
Finished Goods (New)	154.47	
Cost of Sales	497.64	
Manufacturing Overhead in Process (New)		$ 15.42
Variance from Cost Estimates		739.60

To distribute cost variances (Schedule 2).

RAW MATERIALS

8/1	Balance	$ 25,000.00	8/31	Issued (2)	$ 30,240.00
	Purchases (1)	14,728.00	8/31	Inventory end	9,488.00
		$ 39,728.00			$ 39,728.00
9/1	Balance	$ 9,488.00			

MATERIAL IN PROCESS

8/1	Balance (600 × $2.50)	$ 1,500.00	8/31	Finished (11,000 × $2.50) (5)	$ 27,500.00
8/31	Actual 12,000 bbls. (2)	30,240.00	8/31	Inventory end (1,600 × 83% × $2.50) (6) ..	4,000.00
			8/31	Variance (8)	240.00
		$ 31,740.00			$ 31,740.00
9/1	Inventory (6) .	$ 4,000.00			
	Adjustment (9) ..	32.00			

LABOR IN PROCESS

8/1	Balance (600 × 62% × $3.60)	$ 1,339.20	8/31	Finished (11,000 × $3.60) (5)	$ 39,600.00
8/31	Actual 12,000 bbls. (3)	43,680.00	8/31	Inventory end (1,600 × 83% × $3.60 (6) .	4,780.80
			8/31	Variance (8)	638.40
		$ 45,019.20			$ 45,019.20
9/1	Inventory (6) . .	$ 4,780.80			
	Adjustment (9)	70.91			

MANUFACTURING OVERHEAD IN PROCESS

8/1	Balance (600 × 62% × $2.30)	$ 855.60	8/31	Finished (11,000 × $2.30) (5)	$ 25,300.00
8/31	Actual 12,000 bbls. (4)	27,360.00	8/31	Inventory end (1,600 × 83% × $2.30) (6)	3,054.40
8/31	Variance (8)	138.80			
		$ 28,354.40			$ 28,354.40
9/1	Inventory (6)	$ 3,054.40	9/1	Adjustment (9)	$ 15.42

FINISHED GOODS

8/1	Balance (1,000 × $8.40)	$ 8,400.00	8/31	Sold (9,500 × $8.40) (7) .	$ 79,800.00
8/31	Finished Production (11,000 × $8.40) (5)	92,400.00	8/31	Inventory . ..	21,000.00
		$100,800.00			$100,800.00
9/1	Inventory (6)	$ 21,000.00			
	Adjustment (9) .	154.47			

VARIANCE FROM COST ESTIMATES

8/31	(8) .	$ 739.60	8/31	(9)	$ 739.60

COST OF SALES

8/31	Shipments (9,500 × $8.40) (7)	$ 79,800.00			
8/31	Variance Distribution (9)	497.64			

CALCULATION OF EFFECTIVE PRODUCTION

Schedule 1

	Materials	Labor and Overhead
Started previous periods; quantity completed this period	0	228
Started and finished this period	10,400	10,400
Started this period; quantity completed this period	1,600	1,328
Effective Production	12,000	11,956

CALCULATION OF VARIANCE PER EFFECTIVE UNIT

	Variance		Effective Units	Per Unit Variance
Material	$240.00	÷	12,000	$ .02
Direct Labor	638.40	÷	11,956	.0533957
Manufacturing Overhead	(138.80)	÷	11,956	(.0116092)
Net Variance				$ .0617865

DISTRIBUTION OF VARIANCE

Schedule 2

Work in Process		
Material (1,600 × $.02)	$ 32.00	
Labor (1,600 × 83% × $.0533957)	70.91	
Overhead (1,600 × 83% × $.01160923)	15.42*	$ 87.49
Finished Goods (2,500 × $.0617865)		154.47
Cost of Sales		
Material (7,900** × $.02)	$158.00	
Labor (8,128*** × $.0533957)	434.00	
Overhead (8,128 × $.01160923)	94.36*	497.64
		$739.60

* In red

** Effective production as to material		12,000 bbls.
Less: Work in process	1,600	
Finished goods	2,500	4,100
Adjustment cost of sales		7,900 bbls.
*** Effective production as to labor and overhead		11,956 bbls.
Less: Work in process (1,600 × 83%)	1,328	
Finished goods	2,500	3,828
Adjustment cost of sales		8,128 bbls.

Summary and Conclusions. If a single variance is obtained covering in a single amount material, labor, and overhead, all that it is possible to learn is that the estimates were too high or too low by a given amount. The variance itself may be disposed of in various ways, a favorite method being conversion of the inventory and cost of sales at estimated cost to an actual cost base either on the basis of equivalent production or values of the above items.

The more the estimates are subdivided, the more information regarding variances is obtained. However, with greater subdivision, the work of computing and adjusting the estimates becomes so great that the practicality of the system must be gravely questioned. Subdivision by elements of cost seems to represent the limit of practical application of the system. Estimating cost systems can be justified only on the ground of simplicity and ease of operation.

Actually the correction of the estimates through the distribution of variances to inventories and cost of sales accomplishes very little beyond yielding a computed actual value for balance sheet or operating statement purposes. As long as the causes of variances are not inquired into, the accountant, in attempting to correct the estimates, is merely treating symptoms. Thus in the case of style or other product changes involving different proportions of material and labor than obtained previously, the corrected estimates are of no use unless further corrected for the contemplated changes. At best, estimating cost systems serve as an accounting short cut; the use of estimates may also be defended on the ground that they provide a pricing base. They cannot, however, serve as a means of cost control. Where it is desired to secure variances between actual and estimated costs *by causes*, it is much more satisfactory to adopt a system of standard costs such as is outlined in the succeeding chapters.

QUESTIONS

1. Estimating cost systems involve merely one step beyond usual historical types cost systems employing predetermined manufacturing overhead rates. Explain.
2. It has been maintained that estimated costs serve hardly any purpose since variances resulting from a comparison of estimated and actual costs are the results of erroneous estimates. Do you agree? Explain.
3. Are variations from cost estimates period or product costs? Explain.
4. Refer to question 3 and explain the disposition of variances from cost estimates when they are treated as:
   a) Product costs
   b) Period costs
5. Compare the function of the Work in Process account in the following types of cost systems:
   a) Estimated cost
   b) Process cost using historical manufacturing overhead
   c) Job cost using predetermined manufacturing overhead rates
6. Which of the following businesses could advantageously use an estimated cost system?
   a) Contractor engaged in road construction
   b) Food canning factory
   c) Manufacturer of furniture in job lots

d) Producer of fine chemicals

e) Contractor on cost-plus-fixed-fee contract with the federal government

7. What significant features of cost analysis attributable to a system of estimating costs could you list in justifying the institution of such a system?
8. What advantages are attributed to the use of separate cost element work in process accounts in place of a single process account in an estimated cost system?
9. If responsibility for variances is to be charged to specific department supervisors, they should participate in preparing the estimates. Explain from an organizational view who would be involved in preparing the estimate for direct material and direct labor and how divergent views may be reconciled.
10. Indicate how the use of estimated cost systems facilitates the task of inventory valuation.

Chapter 16

STANDARD COSTS—MATERIALS AND LABOR

Characteristics of Standard Costs

Types of Predetermined Costs. Predetermined costs may be either estimated costs or standard costs. Various other terms, viz., "scheduled costs," "planned costs," "specification costs," and "predicted costs," have been used and there have been many discussions of the supposed differences between the kinds of costs designated by these various names during the years when standard costs were being developed. These differences are now generally recognized to be unimportant. Estimated costs are primarily the result of an attempt to determine what the actual cost *will be*. On the other hand, standard costs are intended to tell what the actual cost *should be*. When the actual costs are found to differ from the estimated costs, the estimates are usually considered to have been in error and they are corrected for future use. When the actual costs are found to exceed the standard costs, the actual costs are viewed as wrong because material has been wasted, labor time has not been efficiently used, or some other condition has made the product cost more than it should have. In this case the standard cost is not changed unless there is genuine reason to believe that it was incorrectly set in the first place. Instead, action is taken to bring the actual costs into line with standard costs in the future.

While it may be said that the difference lies primarily in the care and precision with which the costs have been determined, there is in practice no clearly distinguishable difference between standard costs and estimated costs, for they tend to shade into one another. When standard costs cannot be scientifically set, much can be gained by using the best estimates which circumstances permit. As a matter of fact, estimating cost systems were the historical antecedents of modern standard cost accounting systems. However, the emphasis has changed, and instead of estimating what costs probably will be, management now wishes to know what costs should be with reasonably efficient production. This change of emphasis in predetermining costs has accompanied the move toward scientific management and the general replacement of hunches and guesses with factual information in directing the operations of a business. Such methods make it possible to set standard costs and then to control the processes of production in such a way that deviations from the standards are kept relatively small.

Standards vs. Standard Costs. Standard costs attain their reliability in large part by being based upon quantitative standards. Quantitative standards for material cost represent scientific determinations of the kinds of material that should be used to obtain the desired quality of product and the quantities of these materials needed to make a unit of the product. Similarly standard times are determined for each labor operation in the process of manufacturing and also for the usage of manufacturing facilities and services. These measurements of the amounts of material, labor, and overhead factors which should be consumed in turning out a given quantity of product are often made by engineers, chemists, or other experts in manufacturing techniques. Such quantitative standards are widely used for planning production and to aid in controlling usage of material, labor, and manufacturing facilities.

When these underlying quantitative standards are multiplied by dollar amounts representing the unit cost of each factor (i.e., the cost per ton of steel or the rate per hour for labor), standard costs result. However, many companies which possess standards do not have standard costs. Nevertheless, definite advantages can be gained by converting quantitative standards into standard costs. These advantages are:

1. Where the relative importance of variances (i.e., differences between actual and standard) is not known in terms of cost, expensive time may be wasted to save cheap materials or vice versa. Or much effort may be applied to reducing variances that represent insignificant costs when more important ones are neglected.
2. Executives above the shop foreman level must use summarized data to keep informed. Cost furnishes a basis upon which all operations can be reduced to comparable terms; it is a common denominator and summarizes factual data in reports that are understandable even by those who are not familiar with the detailed operations underlying them.
3. Physical standards have no usefulness for such purposes as inventory costing and pricing, but cost standards are distinctly useful for these purposes as well as for cost control.
4. Physical standards cannot be used to study the gross profit by classes of products, customers, or marketing operations.

At the shop operation level, however, standards are best stated in terms of pieces of material, hours of labor, kilowatt-hours of power, and other physical measures for employees here are concerned with quantities rather than with the amounts which the company pays for such things. For other purposes the quantitative standards should be converted to standard costs. Hence those companies which do not use standard costs do not make full use of their quantitative standards.

Relationship Between Standard Costs and Actual Costs. An accounting system incorporating standard costs is not an alternative to one employing actual costs, for standard costs cannot wholly replace actual costs in accounting. The net profit figure shown on the profit and loss statement is obtained by deducting actual costs from actual sales revenues of the period. When standard costs are employed for costing production and sales, the difference between standard costs and actual costs is taken into account before arriving at the net profit for the period. In simplified form, this calculation may be illustrated as follows:

Sales	$100,000.00	
Less: Returns, allowances and other deductions	5,000 00	$95,000.00
Cost of Goods Sold		
Standard cost of goods in opening inventory	$ 20,000 00	
Add: Standard cost of goods manufactured during period	50,000.00	
Total goods available (at standard)	$ 70,000 00	
Less: Standard cost of goods in closing inventory	30,000.00	
Standard cost of goods sold	$ 40,000.00	
Add: Unfavorable variance between actual and standard costs of manufacturing during period	600.00	40,600.00
Gross Profit		$54,400.00
Selling and Administrative Expenses		40.000.00
Net profit before income taxes		$14,400 00

Standard costs really are a complement rather than an alternative to actual costs. For some purposes standard costs are more useful than actual costs, for other purposes actual costs are necessary, and for still other purposes a comparison of the two is more useful to management than either standard or actual costs by themselves. In a complete plan of cost accounting both are needed.

Relationship Between Budgets and Standard Costs. Both budgeted costs and standard costs are predetermined costs and represent an application of the same basic idea. The principal difference lies in the scope of the terms, for "budget" is a broader word than "standard cost." Budgeting comprises the setting of objectives for all aspects of income and expense, whereas standard costs include only regular costs of operation. When standard costs are available, they are generally used in budgeting the cost of goods to be manufactured.

Principle of Exceptions. The difference between a standard cost and the corresponding actual cost is termed a variance. Regular comparison of actual and standard costs enables management at all levels to keep informed on effectiveness of performance with respect to cost elements, departments, and cost centers, individual products, or product lines. The effectiveness of comparisons of actual and standard costs is based on the principle of exceptions, which makes it possible for the cost accountant to sift from the great mass of his cost data the essential facts needed by management. In effect, this means that so long as actual costs are equal to standard costs, no further attention need be paid to them. For those costs that vary from standard, the variance is examined to see whether it is favorable or unfavorable. When actual cost is greater than standard cost, the variance is termed unfavorable. Conversely when actual cost is less than standard, it is considered favorable. In examining variances, the executive can concentrate on the unfavorable variances which may call for extensive investigation to determine the basic causes of the bad showing with a view toward remedial action. It is this pinpointing or highlighting of specific weaknesses that is referred to as the principle of exceptions.

Variances. Waste in the use of material, the purchase of materials at a price in excess of standard, and the inefficient application of labor time are examples of causes which result in unfavorable variances. Such variances are usually viewed as losses. Favorable variances can arise from better than usual experience with waste and scrap, from the purchase of materials at less than standard price, or from production at a rate above standard volume.

Variances from standard cost can be expressed either in amounts or in percentages. In the first instance, the variance is computed by subtracting actual cost from standard cost. If the actual exceeds the standard cost, the variance is a negative figure (i.e., unfavorable and represents a variance loss) ; if actual cost is less than standard cost, the variance is a positive figure (i.e., favorable and presents a variance gain). For example, if standard cost is $1.00 per unit and actual cost is $1.10, the variance is computed as:

$$\$1.00 - \$1.10 = - \$.10$$

If the actual cost is $.85 per unit:

$$\$1.00 - \$\ .85 = + \$.15$$

This method of expressing variances centers the attention of management upon dollar amounts of the differences between standard and actual cost.

Where percentages are used, a cost ratio is first computed by dividing the standard cost figure into the actual cost figure to obtain the actual cost as a percentage of standard cost. Since standard cost is always the base for comparison, the standard cost is considered 100%. When actual cost has thus been converted to a percentage of standard, the actual cost percentage figure can be subtracted from the standard cost percentage (i.e., 100%). The result, which may be either positive or negative depending upon whether actual cost is less or greater than standard cost, is the cost variance expressed as a percentage of standard cost. For example, using the same figures given above:

Cost Ratios	Cost Variances
$\frac{\$1.10}{\$1.00} = 110\%$	$100\% - 110\% = -10\%$ (unfavorable)
$\frac{\$0.85}{\$1.00} = 85\%$	$100\% - 85\% = +15\%$ (favorable)

In contrast with the preceding method, a *relative* variation from standard is provided.

These two methods present complementary aspects of the cost figures in such a manner that both are required for a complete understanding of the cost variation that has taken place. Variances which are large in terms of dollars are sometimes so small in terms of percentages that they pass unnoticed by management if presented in the latter form alone; on the other hand, a large percentage variation may call attention to a substantial deviation from standard cost, yet the present actual loss in terms of dollars may be small.

Types of Standard Costs

Varying Concepts of Standard Costs. In practice and in accounting literature there are different concepts of standard costs. The type of standards in use often has an important effect on the manner in which the standard costs can be used. Hence it is necessary to recognize the principal ways in which one set of standard costs may differ from another set. There are two principal bases for the classification of standard costs, viz.:

1. "Tightness" with which the standard is set, or in other words the relative ease with which the standard can be accomplished
2. Frequency with which the standard is revised

These bases are not entirely unrelated, but serve as practical bases for discussion of standard costs.

Standard Cost Classified as to Tightness. A given standard may be either difficult to meet or it may be easily attained. For example, in a certain operation, production of 50 pieces per hour may be a standard that is readily met or even exceeded by a substantial quantity. Production of 100 pieces per hour may require skill, good direction of work to avoid wasted time or motion, and steady application to the job. Production of 150 pieces per hour may be a rate which represents maximum machine speed, together with the highest degree of skill and effort on the part of the operator. Used as a standard, such a rate is so high as to be unattainable on a sustained basis. The relative ease with which a standard can be met is commonly termed the "tightness" with which the standard is set.

When standards are classified as to tightness, three types can be distinguished:

1. Standards which are readily attained and which allow a substantial amount of avoidable waste and inefficiency. In practice such standards are often based upon an average of uncontrolled past performance.
2. Standards which are attainable, but only by good performance and use of proper methods.
3. Standards which call for so high a degree of perfection that they are unattainable on a sustained basis. They are sometimes referred to as "ideal standards."

The most successful applications of standard costs employ standards of the second type listed above. Such standards are most effective for purposes of controlling costs because they provide fair goals which employees can be held responsible for meeting. Since they can be met only by good performance, they serve as an incentive to maintain reasonably high efficiency. Standard costs set at such a level also are suitable for costing inventories because they include all really necessary expenditures for making the product being costed.

Standard costs which are based upon comparatively low efficiency tend to hide and to perpetuate wastes which should be highlighted in order that management may recognize them as the result of inefficient use of materials, labor, and equipment. Standard costs which are so tight as to be unattainable are ineffective for maintaining efficiency. Employees soon recognize that such standards are unattainable. Whatever his performance, the employee is likely to contend that he has accomplished all that could reasonably be expected and management finds it difficult to sustain the burden of proof to the contrary. Standard costs which are unattainably tight are usually not acceptable for inventory costing since with such standards a substantial portion of the necessary cost is charged to variance accounts rather than to inventory.

Price and Efficiency Standards. Some factors in production cost are often not controllable by management to a significant extent. Examples of these are prices paid for materials and supplies, labor rates, and volume of goods which can be made and sold. Standards for these factors cannot be set in terms of efficiency because employees cannot be held responsible for conditions over which they have little or no control. The principal function of standards for such factors is to aid in analyzing variances in cost by separating and measuring, on the one hand, those items which are due to efficiency of performance, and, on the other, those variations in cost which are due to external factors which cannot be controlled by management. For example, assume that the standards for material going into product A are 100 pounds at $1 per pound. The reasons why actual costs deviate from standard may be either that the quantity used is greater than or less than the standard allowance, or else that the unit price is greater than or less than the standard unit price. The situation for the above standards may be summarized as follows:

Actual Costs			Variance	Reasons
Quantity in Lbs.	Unit Price	Total		
(1) 100	$1.00	$100.00	None	-
(2) 100	1.20	120.00	—$20.00	Price
(3) 100	.80	80.00	+ 20.00	Price
(4) 120	1.00	120.00	— 20.00	Quantity
(5) 120	1.20	144.00	— 44.00	Price and Quantity
(6) 120	.80	96.00	+ 4.00	Price and Quantity
(7) 80	1.00	80.00	+ 20.00	Quantity
(8) 80	1.20	96.00	+ 4.00	Price and Quantity
(9) 80	.80	64.00	+ 36.00	Price and Quantity

In the first case, there is no variance since the actual quantity and price were exactly as predicted. Cases 2 and 3 show pure price variances; the factory consumed only the standard quantity, but the prices paid for the material fluctuated. Cases 4 and 7 show pure quantity variances, since in both cases standard prices were paid. Any variance must therefore result from usage of material above or below the standard. The remaining cases are mixtures of quantity and price variances. Case 5, for example, shows excess usage coupled with prices in excess of standard. Case 6 shows excess usage more than offset, however, by prices below standard. It is seen, therefore, that the total variance from standard is no indication of performance. It must be resolved into its elements to determine whether the quantities, prices, or both are responsible for the variance, and whether these factors are favorable or unfavorable. Unless separate standards have been set for both price and quantity, it is not possible to say which factor has caused the actual cost to differ from the standard cost. The methods by which the factors are analyzed and measured are presented in a later chapter.

Frequency of Revision of Standards. Standard costs may be either current or fixed according to whether they are kept up to date or left unchanged after being set. Standards used for measuring efficiency of performance must represent the methods and quantities or time allowances which are proper at the time the standard is used. Hence these standards must be revised when changes in machinery, materials, product specifications, or operation times occur. When these standards are not current, they are valueless for controlling costs and incorrect for costing inventories.

On the other hand, fixed standards are sometimes used, in the sense that the standards are more or less permanent. The plan of accounting employing fixed standards may be simpler than is possible with either current price standards or actual prices, particularly where a few commodities are used in large quantity. The techniques employed in operating both current and fixed standards are explained in subsequent chapters.

Purposes and Advantages of Standard Costs. The principal purposes for which standard costs are used are:

1. To aid in controlling cost
2. To facilitate and to simplify accounting for costs
3. To provide costs as a guide in pricing products
4. To facilitate the preparation of budgets [1]

Standard Costs to Aid in Controlling Costs. The objective of cost control is to produce the desired quantity and quality of goods at the lowest cost which can be attained under the existing conditions. Before costs can be controlled effectively it is necessary to determine the best way to do each job and how much it should cost to do it. The result of this process is a set of standards. Standards for direct labor and direct material are made up of quantitative standards (e.g., a standard time allowance for each operation and a standard quantity of each material) which are multiplied by standard unit prices (e.g., the rate per hour for labor and the price per unit of material) to yield the standard cost. Standards for overhead costs usually are in terms of an expense allowance for a week or month.

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[1] The presentation which follows is based upon *Research Bulletins*, Nos. 11 to 15, of the National Association of Cost Accountants, published under the title "How Standard Costs Are Being Used Currently" (1951).

Costs can be controlled only by avoiding waste of materials, labor, and overhead. Once materials have been used unnecessarily they are usually lost or have only scrap value. The labor time and the plant facilities, such as light, heat, and power, are gone beyond recovery when no salable product is received from their use. When each person is informed in advance as to how much material and time he should use to accomplish a task and what methods he should use, there need be little waste due to ignorance. Waste due to carelessness or lack of effort is likely to be much reduced because employees are aware that their supervisors have in the standard a definite means of measuring accomplishment. A further appeal to the employee's self-interest may also be made with a wage payment or bonus plan wherein the employee's earnings are based upon his performance under the standards.

Control over costs, as described above, must be exercised before the costs are incurred. However, experience shows that all variances cannot be prevented and hence it is important that when variances do occur action should be taken to keep them from continuing until large losses have accumulated. In order to do this, variances must be brought to the attention of management through reports.

Standard Costs to Facilitate Accounting for Costs. Standard costs are usually incorporated into the accounts by using them to cost inventories and sales. The process is somewhat similar to that described in the preceding chapter on estimating costs. Accounting procedure with standard costs is summarized below:

1. Materials are debited and credited to stores at standard cost. Any difference between standard cost and actual cost of goods purchased is entered in a variance account.
2. Work in Process is debited with the standard cost of materials, labor, and overhead used during the period. Again, any differences between standard costs and actual costs of these cost factors used is entered in a variance account.
3. Finished goods are credited to Work in Process and debited to Finished Goods at standard cost.
4. Goods sold are debited to Cost of Sales and credited to Finished Goods at standard cost.
5. In closing, Cost of Sales and the balance in the variance account are transferred to Profit and Loss. Inventories remain at standard cost and are so shown in the balance sheet.

Standard Costs for Pricing. Cost of the goods to be sold is one of the factors which management usually considers when setting selling prices. It is the function of the accounting department to supply these costs. Predetermined costs are necessary for this purpose because the selling price must be set before the goods are made in most cases.[2] Standard costs are especially useful for this purpose because the quantities of material, labor, and overhead items that should be used to make the goods have been carefully determined. Under such circumstances there is little likelihood that losses will be suffered on sale of the goods because prices were based upon inaccurate costs. Where prices are based upon estimates of cost which may not be accurate, they may eventually prove to be too low to allow a profit on goods sold, or the prices may be set so high that sales are lost to competitors.

When standard costs are used in pricing, consideration is often given to the variances as well. The procedure followed is described in connection with disposal of variances.

Standard Costs for Budgeting. In the preparation of a budget the quantity of goods to be produced during the coming budget period is decided after considering the sales forecast and the size of the inventory desired. It is also necessary to determine the cost to manufacture these goods, for these costs must be used to calculate the cost of sales figure in the budgeted profit and loss statement and the inventory figure in the budgeted balance sheet. A budget presents the company's plans for a future period, but the expected costs of executing these plans are based upon either estimates or standards. Obviously the accuracy of the budgeted costs is directly determined by the reliability of the cost data employed in building up the budget. Again carefully set standard costs furnish a more reliable basis for budgeting than do estimates of cost.

The occurrence of some variance from standard costs is usually anticipated and provided for in budgeting. This procedure is explained later in connection with the dicussion of variances.

Direct Material Quantity Standards

Studying the Product. The cost of material is made up of two factors, viz., quantity and price. A standard must be set for each of these factors. Multiplied together, they result in a standard cost for the direct material element in a unit of product. The setting of standards for quantity and for price each presents somewhat different problems and hence they are discussed separately.

Before standard costs can be set, definite knowledge concerning the product must be available. For a concern that makes only a narrowly limited line of products subject to little variation, this problem is virtually solved in advance; but for a producer of a wide and perhaps continually changing variety of goods, items to be manufactured during the coming period should be listed and complete manufacturing specifications procured. When the plant works largely or wholly upon a product produced to customers' orders and when the same design may seldom be used a second time, it is still possible to classify the product into general types and to find ways in which the special orders are alike. Thus they may be made from the same materials, or many parts and subassemblies used in special jobs may be standard and interchangeable. However, where diversity is present in a very large measure, as in building construction, the drawings and specifications for each order supply basic data and new standards must be set for each construction order received.

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[2] Contracts to sell at cost plus a fixed fee are exceptions, but such pricing methods are largely limited to goods made for government use.

Material Kind and Quality Specifications. The next step is the development of material kind and quality specifications. This is known as setting material usage standards and involves a determination of what is the best and most economical material to use for each purpose. To this end raw material sources must be investigated, methods of purchasing must be considered, and such matters as the most desirable quantities to purchase and stocks to carry must be carefully determined. The engineering and production departments should record all pertinent facts with respect to the kind and quality of raw materials and supplies to be carried in stock; the kind, quality, and quantity of raw materials to be used for specific parts; the method and sequence of processing; part description and quantity requirements in assemblies; and lists of material for final assembly or finishing operations. Where variations in quality exist, these must be measured and the most economical quality for the specific purpose must be decided upon.

Even though this process of fact finding may be lengthy and quite expensive, as it is in a large plant making a diversified line of products, potential savings discovered from this work alone often return the costs of the program. These savings arise from elimination of excessive variety in materials, reduction in inventories, better prices from purchasing standard items in larger volume, use of less expensive kinds of material where they will serve the purpose just as well, and avoidance of delays from having to wait for special items that are not carried in stock by the user or by vendors.

Material Quantity Specifications. Quantity specifications take the form of standard usage specifications, showing standard quantities to be consumed in each manufacturing operation. For an industry where processes are simple, these usage specifications are merely a list of things used per unit of finished product turned out. Where the manufacturing process is more complex and involves manufacturing of parts and their assembly later, perhaps in several stages, it is desirable to have a separate set of usage specifications for each stage in the process beginning with a standard list for each part, other lists for each subassembly, and finally still other lists for each final assembly. In some industries the material quantity specifications take the form of standard formulas or mixtures, prepared in many cases by chemists. An illustration of a standard material mixture specification sheet for an iron foundry is given in Figure 89.

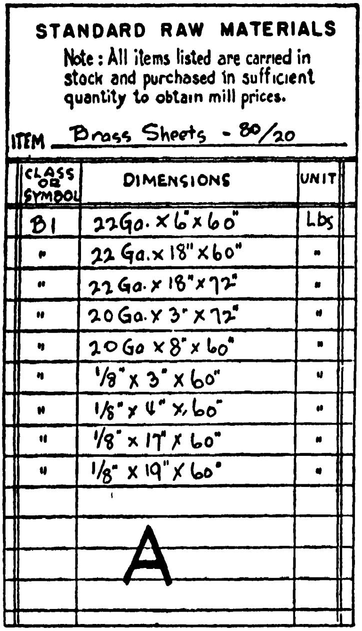
STANDARD FOUNDRY MIXTURES

	STANDARD QUANTITIES -PER CHARGE		
	MIXTURE No 1	MIXTURE No 2	MIXTURE No 3
METAL USED			
PIG IRON — ZENITH	240	100	260
MAYARI			80
SPEC. F S.	10		
TOTAL PIG IRON	250	100	340
SCRAP FOREIGN G.I.	390	700	
STEEL			80
MALLEABLE			160
REMELT	160		220
TOTAL SCRAP	550	700	460
TOTAL METAL USED	800	800	800

FIGURE 89. Foundry Mixture Standards

Records of Material Quantity Standards. It is important to keep full records of all material quantity standards. Raw materials such as sheets, rods, bars, and other standard shapes of metals; lumber, cotton, wool, rayon, burlap, and silk fabrics; and other similar standard materials of all kinds can be adequately described on standard raw materials lists such as those illustrated in Figure 90. Purchased fabricated parts which are available in various sizes can be described on standard parts charts.

Most manufacturing concerns, however, produce many fabricated parts from standard raw materials or from special castings and forgings of their own design. All special parts of this nature should be fully illustrated on drawings produced by the engineering department. Such drawings should leave nothing to the imagination of the workman and should show not only finished dimensions, but also a complete description of raw material from which parts are to be made. Standard raw



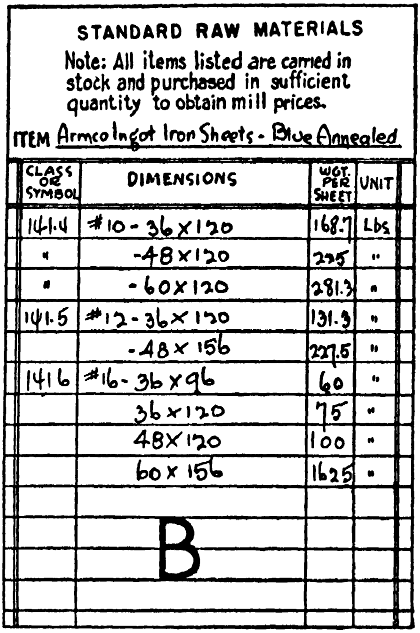
STANDARD RAW MATERIALS

Note: All items listed are carried in stock and purchased in sufficient quantity to obtain mill prices.

ITEM Brass Sheets - 80/20

CLASS OR SYMBOL	DIMENSIONS	UNIT
B1	22Ga.x6"x60"	Lbs
"	22 Ga.x18"x60"	"
"	22Ga.x18"x72"	"
"	20Ga.x3"x72"	"
"	20Ga x8"x60"	"
"	1/8"x3"x60"	"
"	1/8"x4"x60"	"
"	1/8"x17"x60"	"
"	1/8"x19"x60"	"

A



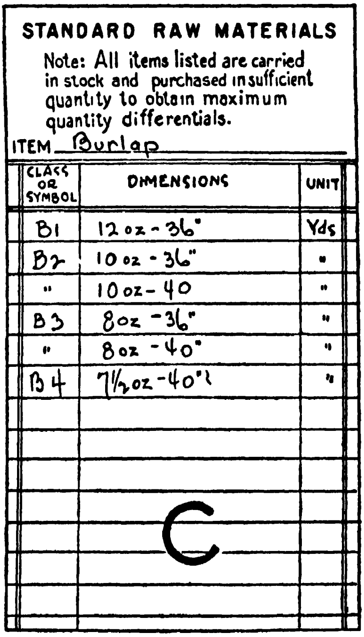
STANDARD RAW MATERIALS

Note: All items listed are carried in stock and purchased in sufficient quantity to obtain mill prices.

ITEM Armco Ingot Iron Sheets - Blue Annealed

CLASS OR SYMBOL	DIMENSIONS	WGT. PER SHEET	UNIT
141.4	#10-36x120	168.7	Lbs
"	-48x120	225	"
"	-60x120	281.3	"
141.5	#12-36x120	131.3	"
	-48x156	227.5	"
1416	#16-36x96	60	"
	36x120	75	"
	48x120	100	"
	60x156	1625	"

B



STANDARD RAW MATERIALS

Note: All items listed are carried in stock and purchased in sufficient quantity to obtain maximum quantity differentials.

ITEM Burlap

CLASS OR SYMBOL	DIMENSIONS	UNIT
B1	12oz-36"	Yds
B2	10oz-36"	"
"	10oz-40	"
B3	8oz-36"	"
"	8oz-40"	"
B4	7½oz-40"	"

C

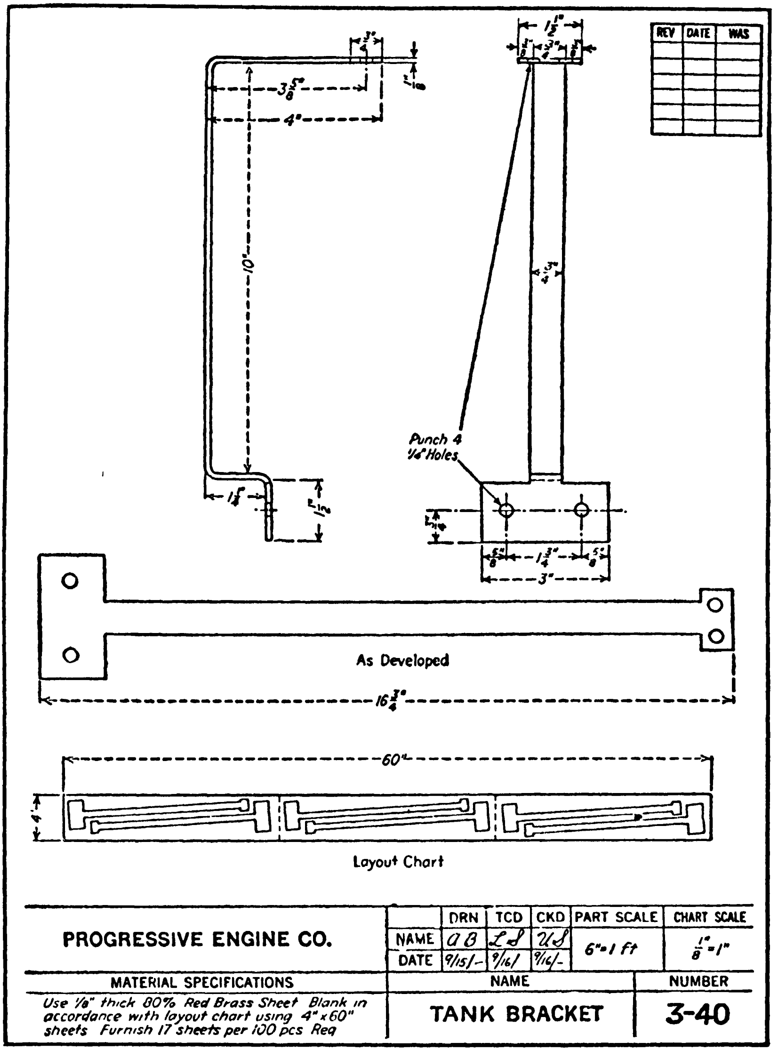
FIGURE 90. Standard Raw Materials Lists

materials lists should be referred to in determination of raw materials to be used to avoid addition of new items to inventories if a satisfactory size and kind of material is already carried. The type of drawings described above is illustrated in Figure 91. This drawing provides a description of the part; states the part number used for identification; specifies the kind of material to be used and, by means of a layout chart, the manner of cutting the part from strip brass in order to minimize material wastage. The company from which this illustration was taken supplements its technical blueprints with route sheets which set up a permanent record of manufacturing processes together with a record of tools needed. When job number and quantity have been inserted, they are also used as production orders.

Shrinkage, Scrap, and Waste. An important factor to consider in setting material usage standards is that of shrinkage, scrap, and waste. Many materials are subject to shrinkage or unavoidable deterioration while in storage or in the process of being worked upon. Thus a certain loss in yardage occurs from shrinkage when dyeing cloth, and a loss of weight takes place in the curing of meats. Other types of manufacturing result in the production of scrap, as in punching gaskets from sheets of cork. A third source of loss is wastage of materials which have been spoiled or rendered defective by inaccurate or careless work. While flowing from somewhat different causes, all of these are responsible for losses of material put into process.

When loss normally takes place while materials are in stores (from leakage, evaporation, or deterioration) the price at which the materials are charged out to Material in Process must be increased to cover the amount of the loss. For example, in handling a plastic molding powder it was found that a loss of 2% occurred from adherence of the powder to containers, spilling, and shrinkage in storage. Since the powder cost 20 cents a pound at the time it was taken into raw materials inventory, it was charged to work in process at 20.408 cents a pound to provide for the 2% loss in storage and handling.

Determining Amount of Allowance for Material Loss. The amount of the allowance for waste and scrap which is included in the standard material usage depends principally upon the tightness with which the standard is set. Waste, scrap, and other loss which is an inevitable accompaniment of the process, even with the best of care, should be included in the standard cost of the product. This means that unavoidable losses occurring while material is in process must be compensated for by increasing the usage standard since the standard cost of a unit of product should include the cost of all of the material necessarily used in making the unit.



Use 1/8" thick 80% Red Brass Sheet Blank in accordance with layout chart using 4" x 60" sheets Furnish 17 sheets per 100 pcs Req

FIGURE 91. Drawing and Standard Layout Chart

Most companies prefer attainable standards and hence allow for such wastage and loss of materials as they consider it impractical to eliminate. In that case standards are ordinarily set to require good performance under the circumstances expected to prevail. These vary in different companies and also with the kind of material and manufacturing processes. For example, when materials received are not uniform in quality, when machines are not in good repair, or when accurate standards for materials have not been established, standards cannot be as tight as when better conditions prevail.

Direct Material Price Standards

Responsibility for Material Price Standards. Setting of material price standards calls for fixing a standard unit cost for each kind of material used; the result is a list or catalog of standard material prices. The most important questions which arise in setting material price standards concern the use of the standards for costing inventories, for pricing products, and for budgeting. Prices paid for materials are determined largely by external conditions in the market and hence price standards have only limited use in controlling the cost of materials. However, the purchasing department has some responsibility in connection with prices. Hence, the efficiency of some aspects of purchasing performance can be measured by price standards. Thus the standards should be based upon prices obtainable by purchasing in the most economical quantities, shipping by the cheapest method of transportion, and buying under the most favorable terms available.

Material price standards may be (1) current standards, (2) normal standards, or (3) fixed standards. Pricing of the standard material specifications depends on the nature of the standard used.

Current Price Standards. Most companies prefer to have their material price standards represent what the actual cost of materials is expected to be. For this reason, material price standards are set by a forecast of prices anticipated during the coming period or, if no important change is expected in prices, prices in effect at the date the standard is set. Thus some companies consider their material price standards as the best possible estimate of the average price which will be paid for each material over a year. Many companies contract for their materials considerably in advance of the time when they are to be used and the contract price then becomes the standard material cost. In other cases it is customary to carry large stocks of raw materials and here the price actually paid is available as the standard cost. Current material price standards should be reviewed and brought up to date once a year just prior to the annual closing.

Normal Price Standards. Normal price standards are set by averaging prices paid over *a period of years,* usually after eliminating periods affected by wars, extreme depressions, and other extraordinary circumstances. Most elaborate statistical techniques which take into account such factors as seasonability, trends, and the business cycle are also sometimes used. Price figures developed by such methods must then be projected into the future since the aim is to obtain prices which will be suitable standards for several years ahead. At any given time actual prices may vary considerably from normal standard prices because the latter are intended to level out fluctuations in actual prices. Normal standard prices are generally revised at intervals of several years or when actual prices deviate consistently in the same direction from the standard for a long period of time.

Fixed Price Standards. Under this method prices current at the date the standard is set are generally used. Once set, the standard prices are not revised unless changes in specifications or technology or important changes in actual prices have occurred. Fixed price standards are used to simplify the process of accounting for cost of inventories. When fixed price standards are in use, inventories are stated at actual cost since the standard cost of materials contained in the inventories usually differs substantially from actual cost.

Setting the Standard Cost for Direct Material. When standards have been set for the quantity of material that should be used to produce a completed product unit and for the unit price of the material, the standard cost of direct material is determined by multiplying the standard quantity by the standard price. A separate standard cost is set for each material used.

Direct Labor Time Standards

Standardizing Conditions of Work. Setting direct labor cost standards is a process closely analogous to that employed for setting material cost standards, but the techniques employed differ markedly since human operators are involved rather than inert substances. Paralleling the method for setting material standards, the first step is selection of the best operating method available, in order that it may be used as a basis for the standards. This includes standardization of all surrounding conditions that influence the effectiveness with which the worker performs his task:

1. Consideration of layout, conditions of equipment, the workplace, and internal transportation facilities to standardize the best practicable arrangement of these under existing circumstances.
2. Establishment of control over the flow of materials in order that the workman may have the correct quality and quantity available in the proper place. This requires investigation of purchasing, receiving, and storeskeeping methods, of the plant transportation system, and the placing of materials at workbench or machine.
3. Development of a system for planning, routing, and dispatching of work to insure the arrival of the material at the proper time.

4. Provision of all needed instructions for the worker in the form of advance training or directions for each specific job.

Since standard costs are based upon methods and conditions which it is desired to attain, variations of actual from standard then become indicative of real variations in efficiency relative to the standards. Lacking definite specifications of what methods should be used and what the surrounding working conditions should be, it is hardly possible to locate the underlying cause for a variation.

Standard Process Data. Factual data covering manufacturing processes are essential in setting labor operation standards. This takes the form of preparing an accurate record of all the direct labor operations required to manufacture each product as well as of their sequence. When the products are composed of several parts or subassemblies, each of these should be studied separately and individual operations necessary to complete the part should be listed in the sequence in which they are performed in the manufacturing process. This listing is made on a form called a standard process sheet. It shows for each part or product the best process of manufacturing with the equipment available. When standard operation time allowances are based upon standard process data, the use of less efficient alternate processes results in a variance loss, thereby calling attention to the deviation from standard procedure. Such deviation will of course be reported to management.

Setting Standard Operation Time Allowances. Establishment of standard operation time calls for the determination of the time needed to complete each operation when working under standard conditions. Such time standards should be set for performance of each individual labor operation listed on the process sheets rather than for the total labor time needed to produce a completed product unit. The individual operation time standards are added together in determining the standard cost of the finished product, but for purposes of controlling costs at each step, the total cost needs to be broken down into its elements. Many companies already have available complete operation time standards developed for purposes of wage payment and planning of production. These are exactly what is needed as a basis for the labor usage element in standard labor costs.

Where operation times are not already at hand, standard time allowances should be set by one of the following methods:

1. Time and motion study
2. Study of past performance records
3. Estimates based upon experience, judgment, and knowledge of operations

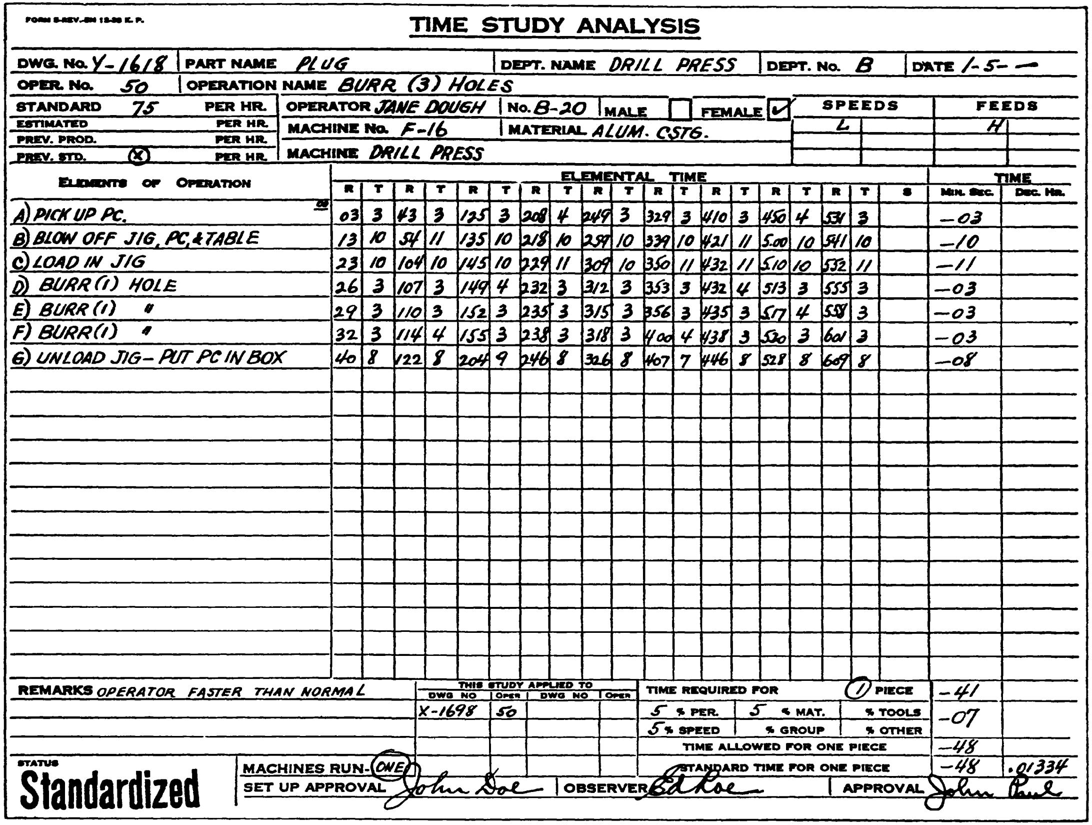
TIME AND MOTION STUDIES. Time and motion studies furnish by far the most satisfactory direct labor time standards upon which to base standard labor costs. In fact it is the only method that can be depended upon to yield standards sufficiently reliable to permit other than a crude analysis of variations. Motion study aims to analyze the manual and machine operations into distinguishable elemental motions. Time study then makes careful measurements of the time required to perform these motions when working under given conditions. In this way time standards are set for the operations to be performed. These labor time standards contain not only the time set as standard for performance of the operation, but also allowances for rest, for necessary machine delays, for setups (if this is not to be considered a separate operation), and any other allowances regarded as essential (Figure 92).

STUDY OF PAST PERFORMANCE RECORDS. A second method is to take an average of past operation times as shown on time cards. When a job order cost system has been in operation, actual time for direct labor operations is available and can be used as the source of data. If extreme figures are first eliminated (because they probably represent unusual conditions or mistakes) and the remaining ones averaged, this average of past performance can serve as a time standard.

If changes in production methods have been made, the setting of standards must await the accumulation of new experience. Another unsatisfactory situation occurs where there is excessive variability in the operation time as a result of conditions over which workers have no control; for example, nonuniformity in material, machine failures, or working conditions that prevent concentration on the job. Such a situation can generally be recognized by the existence of a very wide dispersion in the past operation times or by inspection of the factory. Working conditions must first be standardized before a standard cost system can operate with any degree of satisfaction, for responsibility cannot be placed or causes of variations traced when the sources of variations are too numerous.

However, this method is sometimes useful when it is desired to set approximate standards with a minimum of effort and time. Thus the standards can be put into use and then gradually improved and tightened as studies of the manufacturing operations progress.

ADVANCE ESTIMATE. Another method of determining standard time allowances for operations is to estimate them in advance. These estimates are made by foremen who base them upon their experience, judgment, and knowledge of the operations, or perhaps by engineers who likewise have a knowledge of the operations. This method is particularly useful where an operation has not been performed before in exactly



TIME STUDY ANALYSIS

DWG. No. Y-1618 | PART NAME PLUG | DEPT. NAME DRILL PRESS | DEPT. No. B | DATE 1-5- —

OPER. No. 50 | OPERATION NAME BURR (3) HOLES

STANDARD 75 PER HR. | OPERATOR JANE DOUGH | No. B-20 | MALE ☐ | FEMALE ☑

ESTIMATED PER HR. | MACHINE No. F-16 | MATERIAL ALUM. CSTG.

PREV. PROD. PER HR. | MACHINE DRILL PRESS

PREV. STD. (X) PER HR.

SPEEDS		FEEDS	
L		H	

ELEMENTS OF OPERATION	ELEMENTAL TIME																			TIME	
	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	R	T	S	MIN. SEC.	DEC. HR.
A) PICK UP PC.	03	3	43	3	125	3	208	4	249	3	329	3	410	3	450	4	531	3		—03	
B) BLOW OFF JIG, PC, & TABLE	13	10	54	11	135	10	218	10	259	10	339	10	421	11	5.00	10	541	10		—10	
C) LOAD IN JIG	23	10	104	10	145	10	229	11	309	10	350	11	432	11	510	10	552	11		—11	
D) BURR (1) HOLE	26	3	107	3	149	4	232	3	312	3	353	3	432	4	513	3	555	3		—03	
E) BURR (1) "	29	3	110	3	152	3	235	3	315	3	356	3	435	3	517	4	558	3		—03	
F) BURR (1) "	32	3	114	4	155	3	238	3	318	3	400	4	438	3	520	3	601	3		—03	
G) UNLOAD JIG—PUT PC IN BOX	40	8	122	8	204	9	246	8	326	8	407	7	446	8	528	8	609	8		—08	

REMARKS OPERATOR FASTER THAN NORMAL

THIS STUDY APPLIED TO			
DWG NO	OPER	DWG NO	OPER
X-1698	50		

TIME REQUIRED FOR (1) PIECE			—41	
5 % PER.	5 % MAT.	% TOOLS	—07	
5 % SPEED	% GROUP	% OTHER		
TIME ALLOWED FOR ONE PIECE			—48	
STANDARD TIME FOR ONE PIECE			—48	.01334

STATUS **Standardized**

MACHINES RUN- (ONE)

SET UP APPROVAL John Doe | OBSERVER Ed Roe | APPROVAL John Paul

FIGURE 92. Time and Motion Study Sheet

the same way, is not to be repeated, and represents an operation of considerable consequence. The construction of a building, ship, or a large special job of any other sort furnishes an occasion where this method of setting standards is useful. Quite often estimates are made first to establish a basis for bidding or quoting a price to the customer; after the order has been obtained these same estimates may be utilized as standards to facilitate the control of actual operations in order to make sure that the profit anticipated is not lost by uncontrolled labor costs.

In some circumstances it is feasible to develop empirical formulas, tables, or curves from which standards can be set for operations not previously performed. Such formulas represent the change in allowed operation time as some dimension of the production process is varied. Development of such a formula proceeds by analysis of the process of determining what elements are concerned, and then by studying the way the operation time varies as the other elements are varied. When expressed as a formula or table any value within the range of experience can be derived. The method is called *synthetic rate setting* by time study workers. Standards based on scientifically determined data in this manner may be as good as those obtained from direct observation of the operation.

Tightness of Labor Performance Standards. As with material usage, labor performance standards which represent attainable good performance are the best for cost control purposes. In setting these standards, time study men make allowances for fatigue, personal needs of operators, and unavoidable delays. Frequently additional time may be allowed to cover machine setup and change-over, machine breakdown, waiting time for operators, rework, and paid vacation time. These items may be justified on the theory that while they represent costs of production to the extent that they are unavoidable, they are not related to operating efficiency.[3]

On the other hand, some companies keep tight labor performance standards as a matter of policy. These tight standards are designed primarily for cost control. Where costing or pricing is the principal aim with control incidental, the labor standards tend to be looser.

Direct Labor Rate Standards

Job Classification. Since there is usually considerable variation in rates paid for labor, the first step should be establishment of a classification of labor grades used. This should comprise a definite set of specifications for each grade in order that grades may be clearly distinguishable. Among the characteristics upon which this classification is based are skill, training, education, special physical abilities, and experience. The aim here is to set up a logical basis for differentials in wage rates paid, and to make possible specification of the particular grade of labor that is to be used for each operation in the plant.

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[3] "Standards to Aid Control of Manufacturing Costs," *N.A.C.A. Bulletin*, March 15, 1948, pp. 918-19.

The next step is setting of standard rates of pay for each of these grades of labor. Here, as above, the most satisfactory procedure is to base rates upon a careful study of employee compensation. In this, the procedure is influenced by circumstances under which labor is hired. If a plant operates under contract with a labor union, rates paid workers are fixed by the terms of the contract. In such a case the contract rates form the standard rates. If wages are established by bargaining individually with employees, the prevailing market rate for similar types of work is an important consideration, although it cannot be the sole guide. Most important, perhaps, is the establishment of a rate which fairly represents the qualifications of the job relative to other jobs in the plant.

If the standard is not to be set by so complete a study, the best approach is to use average rates paid in past periods, modifying these if necessary to bring them into accord with actual conditions anticipated. For this purpose, departmental payroll figures may be divided by the respective totals of hours represented to obtain average hourly rates, although in circumstances when a department uses several distinctly different classes of labor the departmental totals need to be broken down by classes of labor in order that a representative average rate of compensation may be obtained.

Effect of Wage Payment Plan on Rate Standards. The wage payment plan in use necessarily requires consideration when setting a labor cost standard, for different wage plans do not result in the same unit cost for labor. Three basic types of wage payment plans may here be distinguished, viz.:

1. Day or hourly wage plan
2. Single piece rate
3. Multiple piece rates, bonus, and premium plans

Day or Hourly Wage Plan. Where day rates prevail the standard labor rate is that hourly rate which represents the expected or normal rate to be paid for a particular grade of labor needed to do the task. If this rate is actually paid to all employees, no labor price variance appears, but if some employees are paid higher or lower rates a price variance appears.

When different rates are paid as a matter of policy, recognizing such factors as length of service, versatility, experience, and similar things, variances cannot be looked upon as the result of a deviation from expected or desired results and hence it becomes necessary to reflect these differences in the standard labor price. This can be accomplished quite easily by use of a weighted average hourly rate computed by weighting each different hourly rate by the number of men expected to be employed at that rate. By using this weighted average rate as a standard labor cost, the total standard labor cost will not deviate from the actual cost by reason of the existence of those wage differences established as a matter of policy.

Single Piece Rates. Under a single piecework plan, the standard labor cost of a unit of product is the piecework price regardless of the number of pieces made in a day by the worker. Any deviation from the standard labor rate per piece causes a price variance to appear. Piece rates are not changed without also revising the standard labor cost, but frequently work is done on an hourly basis instead of piecework. Among the reasons for such day work are provision of a fair wage for new employees, provision of a fair wage for employees working under nonstandard conditions, or to care for nonroutine operations on which no piece rates have been set.

Changes from piece rate to hourly wage result in labor variances where the standard costs are based on the piecework rate, for efficiency is usually lower under a time wage than under a piecework plan of compensation.

Multiple Piece Rates, Bonus, and Premium Plans. Where incentive wage systems of this character are in use, labor cost per unit of output varies according to the rate of output and also according to the type of earnings curve that the wage plan yields. Thus direct labor cost per unit of output is, under multiple piece rate plans, constant within the limits to which each rate applies, but contains a step for each rate. Premium and bonus wage plans yield various direct labor cost curves as output is increased, depending upon the nature of a particular compensation plan. When wage plans like these are in use, the standard labor rate is generally set at the figure which most employees are expected to earn. Thus the standard rate includes the average bonus or premium to be earned.

QUESTIONS

1. Differentiate between quantity standards and standards expressed in dollar values. What special advantages are attributed to the latter type of standards?
2. Indicate the extent to which the size of the enterprise and the nature of the productive process affect the possibility of installing a system of standard costs.

3. The final profit and loss statement produces an actual net profit regardless of the kind of a cost system employed. Do you agree? Explain.
4. The early financial history of this country reveals the use of budgets in the colonies. The Colonial governor presented his budget to the local government body. Did the budget so prepared imply the use of standards? Explain.
5. The principle of exceptions implies selective analysis rather than analysis based on sampling or averages. Explain.
6. The financial accountant compares actual performance of one period to another and indicates deviations. Indicate the shortcomings of this type of analysis when used for cost control purposes.
7. Explain how standard costs contribute to cost control.
8. Explain why prices based on standard costs are considered superior to those based on estimated costs.
9. A significant advantage attributed to a system of standard cost occurs in connection with inventory valuation. Explain by reference to ease of valuation and the practice of deferring into inventory excess costs due to inefficient operations.
10. How do inventories at standard reduce the cost of cost accounting?
11. List three methods which may be used to set material quantity standards.
12. "The engineering department determines what material and quantities will be needed to make the product. This is an ideal standard." List the adjustments generally made to convert to a material quantity standard.
13. In a manufacturing plant, who is generally responsible for setting material quantity standards and who initiates changes?
14. Price variances are affected more by external conditions than by internal control. Why is it necessary to have material price standards?
15. Credit variances are generally looked upon with favor. In setting price standards, a purchasing agent could urge standards based on prices higher than those he would probably pay, thus achieving a favorable price variance.

    a) What would be the effect on profits of such a practice?
    b) How could such a practice be prevented?
16. Differentiate between normal, current, and fixed price standards.
17. List the steps in setting labor time standards.
18. In setting material quantity standards the task is simplified because one deals with inanimate objects. How is it possible to set standards for labor time as long as there are individual differences among members of the labor force?
19. What allowances should be included in the standard labor rate?

20. The Burrows Company manufactures brushes and has established in all departments except one direct labor standards by products (styles) and standard amounts for indirect labor classified as housekeeping, materials handling, supervision, etc. The exception is the tumbling department in which a crew of men has charge of placing brush handles in barrels, keeping the barrels supplied with polishing materials, removing the handles from the bath, and transferring them to the next department.

    Because a variety of products with tumbling times running from 4 to 16 hours may be simultaneously processed and because there is a certain amount of idle time and retumbling of items, the company sees difficulties in arriving at standard or actual direct labor product charges that would be applicable to the operations of this department and in isolating and setting standards for indirect labor costs.

    Suggest possible approaches to the problem of deriving a base upon which to set a standard for direct and indirect labor.

Chapter 17

STANDARD COSTS—OVERHEAD

Standard Capacity

Characteristics of Manufacturing Overhead. The problem of setting standards for manufacturing overhead may be divided into two parts:

1. Standard capacity as a basis for costing production
2. Standard costs as a basis for the control of manufacturing overhead.

Historically, the use of standard overhead rates for applying factory expenses preceded the incorporation of standard direct material and standard direct labor costs into the accounts. In fact, many companies today use standard overhead rates without using standard costs for direct material and direct labor. It may be pertinent therefore at this point to re-examine some principles of overhead application to the product so far as they relate to the problem of predetermining standard overhead rates.

Concept of Normal Overhead. The basic concept of normal overhead is that the actual cost is not necessarily the best criterion of the true cost, but that the proper amount of overhead to be charged to the product is expressed in a rate based on standard volume. Two elements are thus involved:

1. Normal production, involving a determination of normal capacity
2. Normal expense, involving a determination of the allowable overhead at normal volume

Normal Capacity. Normal capacity may be defined as that capacity of a plant at which it produces a physical volume of goods sufficient to meet the average sales demand over a period of time long enough to level out the peaks and valleys resulting from seasonal and cyclical causes. Ideally the capacity to produce should, in the long run, equal the capacity to sell. Such perfect conditions seldom prevail. For short periods of time a plant may find itself unable to fill all orders, while at other times the plant may have considerable excess capacity because of a slack season or depressed economic conditions. Normal capacity is therefore often thought of as a kind of average capacity.

No fixed rule exists for determining the number of years entering into the composition of a normal rate, which should take into consideration the plant operations that fluctuate with respect to general business conditions. Normal operation represents the average production for a complete business cycle. Thus the concept of normal capacity is bound to change with the times. Manufacturing industry has been going through great changes, at an accelerating rate, in developing new raw materials, new improved processes, and automatic equipment. With the advent of World War II a new cycle was started and there is no reason to doubt that what was normal some years ago must give way to a new basis of values and standards in establishing normal overhead for the years ahead. It is for this reason that the term "normal capacity" has tended to fade into the background. The terms "standard capacity" and "standard overhead rates" are more descriptive of the nature of these items.

In reality, standard capacity may be defined in two ways:

1. The *practical capacity* of a plant to produce, or what a plant could do if there were no lack of orders. This is less than the maximum physical capacity by the amount of unavoidable idleness for repairs, unforeseeable breakdown, shortages of material or labor, and other interruptions that are not humanly preventable (Figure 93).
2. The *average capacity* of a plant to produce and sell. This view of standard capacity allows both for unavoidable interruptions in a factory and for an average amount of idleness due to lack of sales orders.

Standard capacity at any chosen level may be determined for one-, two-, or three-shift operation, or for whatever length of working week the company expects to maintain. Experience indicates that either concept of standard operating level may be used, depending upon the preference of those managing the business. It should be realized that the *activity level* chosen is one at which 100% of the fixed overhead is absorbed by the product, and also that it is the level from which under- or overabsorbed activity variances are generally measured. Thus, for example, if standard capacity is fixed at 85% of maximum capacity, while actual operations resulted in only 60% utilization there would be idle capacity cost (unabsorbed fixed charges) measured by the difference in cost at 60% and 85% of capacity. On the other hand, if standard capacity is placed at sales expectancy of 65% while actual operations were at the 60% level, unabsorbed expense is measured by the difference in cost at 60% and at 65%.

The chief purpose in establishing standard capacity is to obtain a base for determining standard overhead rates. Use of a standard overhead, instead of actual, to apply to production has the great advantage of eliminating from unit costs those fluctuations due to changes in the volume of output. In this way it becomes easier to discover changes in costs caused by other factors, and to determine their extent. There is a general recognition of the fallacy of a costing scheme which produces higher costs in periods of low production and lower costs as production rises. Such costs are generally considered incorrect, unsound, and unsafe in providing a basis for a well-considered manufacturing or financial policy. The use of standard overhead rates is the answer to this problem because of the stabilizing effect they produce on costs.

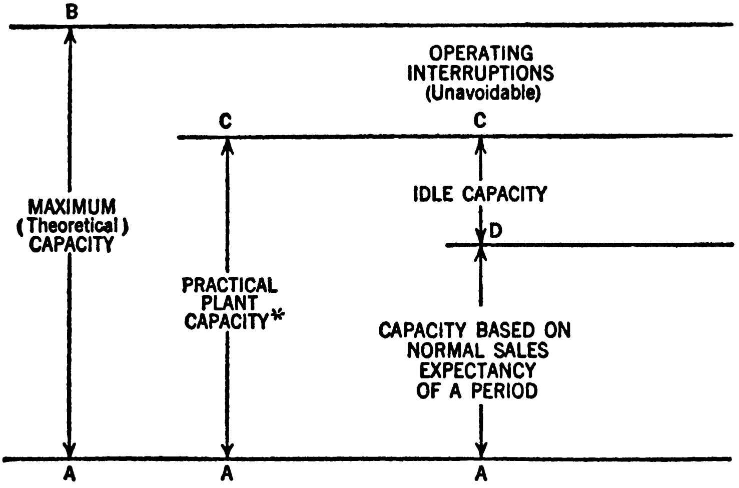


FIGURE 93. Capacity Relationships

* Based on capacity to produce.

An example of how practical capacity is determined in a cigar manufacturing plant is furnished in the tabulation of Figure 94. There the standard capacity is obviously equal to the practical plant capacity figured at 92% of theoretical maximum (100% minus 8% for operating interruptions).

Standard Overhead Rates. The generalized formula for computing a standard overhead rate is:

$$\frac{\text{Manufacturing overhead at standard capacity}}{\text{Standard production}} = \text{Standard overhead rate}$$

Standard production may be measured in terms of units of physical product, time of productive effort, or dollars.

STANDARD PRODUCTION CAPACITY

Schedule of production hours:	
Total days in year	365
Less 52 Sundays, 11 holidays, and 6 days inventory closing	69
Scheduled working days for year	296
Average hours per day (5 at 8¾; 1 at 4¼)	8
Annual schedule hours—gross	2,368
Machine repairs, adjustment and overhauling—8%	189
Net annual scheduled hours	2,179

STANDARD MACHINE CAPACITY

Kind of Cigar	(1) Number of Machines	(2) Production per 8¾-Hour Day per Machine	(3) Production per Hour (2) — 8¾	(4) Annual Machine Hours 2,179 × (1)	Annual Production (Thousands) (1) × (4)
Londres	22	4,000	457.1	47,938	21,912
Perfecto	8	4,000	457.1	17,432	7,968
Cabinet	78	4,000	457.1	169,962	77,690
Panetela	4	4,000	457.1	8,716	3,984
Endicott	12	4,000	457.1	26,148	11,952
Midget	22	4,000	457.1	47,738	21,912
Junior	8	4,000	457.1	17,432	7,968

FIGURE 94. Computation of Standard Machine Capacity

Where there is uniformity of product, it is convenient to express capacity in physical units; where there is a variety of product made from a diversity of raw materials, the productive hour serves as common denominator for measuring plant activity. This may take the form of labor hours or machine hours. Finally, standard production may also be expressed in labor dollars or other dollar measurement.

Rates may take the form of blanket, departmental, or cost center rates. Where departmental burden rates are used, it is necessary to determine the standard capacity for each department in the plant. In general, there are two possibilities:

1. Set standard capacity for each department without regard to its relation to other departments in the plant.
2. Set the standard capacity of the "bottleneck" department, and relate all other departments to that standard.

BUDGET AT STANDARD CAPACITY

Department—Cone Automatics
(2 machines per operator) Year______

	Amount
Direct Charges per Annum at Standard Volume:	
Indirect labor	$ 26,960.00
Supplies	3,869.00
Tools ..	23,306.00
Power .	9,251.00
Maintenance	11,004.00
Losses—product scrapped, repairing defective product, waiting for tools, waiting for materials	6,923.00
Property insurance, taxes, depreciation	32,073.00
Total direct charges	$118,930.00
Service Department Charges at Standard Volume:	
Utilities—boiler plant, service water, compressed air, heating system, butane gas plant, solution lines	$ 1,168.00
General building expense—fire department, safety department, general maintenance, laborers .	15,293.00
General tool expense—toolroom, apprentice school, tool planning	10,776.00
General maintenance expense—machine shop, maintenance department	1,698.00
General overhead—factory manager's staff, material control department, machine and tool development, labor standards, factory accounting, purchasing . . .	35,154.00
Total Service Department charges	$ 64,089.00
Total charges per annum at standard volume . .	$183,019.00
Standard productive labor dollars per annum	$ 40,320.00
Standard overhead per cent of labor cost	454%

FIGURE 95. Standard Direct Labor Cost Rates

Figure 95 is an illustration of the determination of departmental standard rates based on direct labor dollars. The rate of 454% is used to cost all production going through the cone automatics department. Similar applications may be worked out for the other methods referred to above.

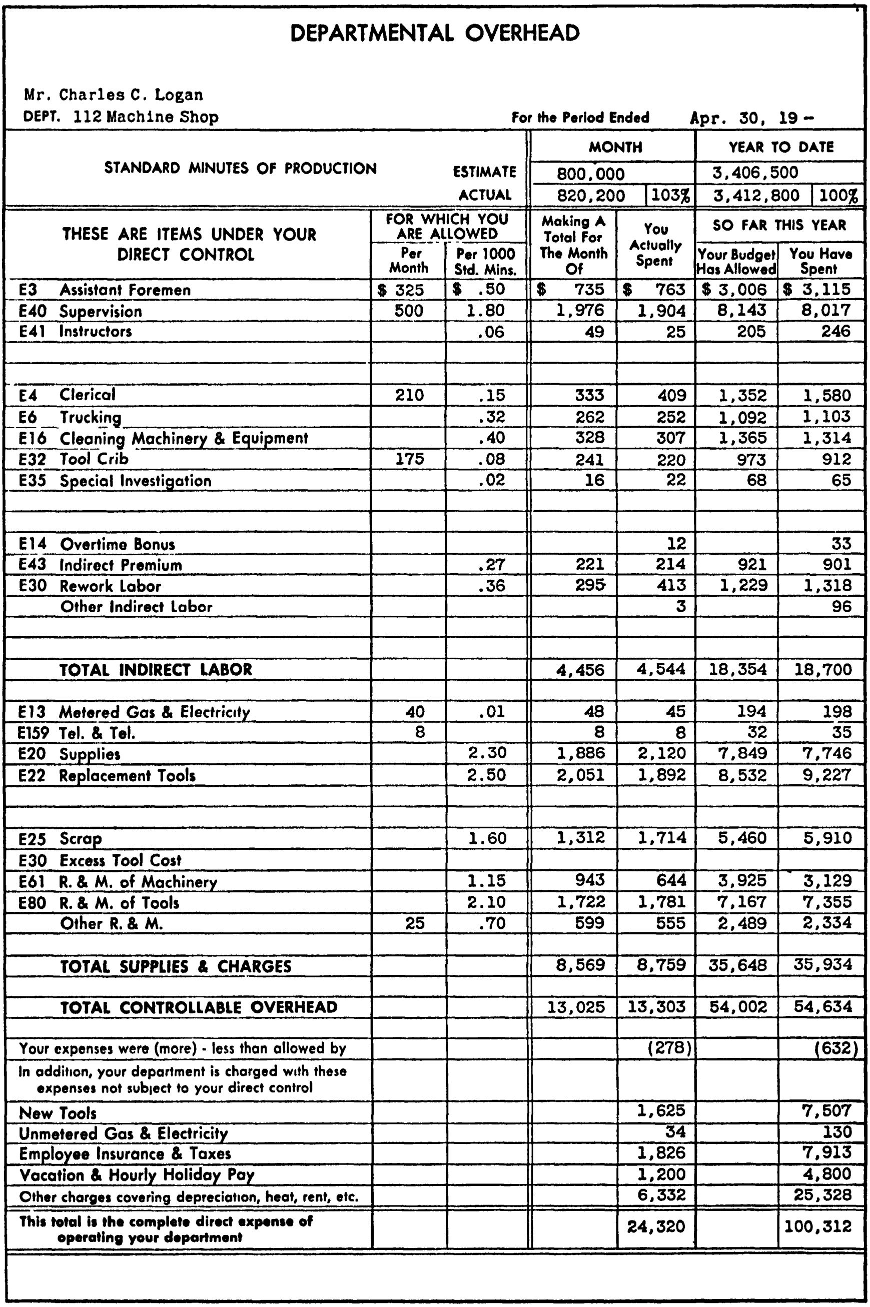
Control of Factory Overhead

Budgetary Control. Overhead costs cannot be controlled by watching the amount of cost incurred in producing each unit or lot of product, for it is impractical or impossible to associate usage of such production factors as indirect labor, factory supplies, occupancy of buildings, and operation of machinery with specific units or lots of product turned out. Instead, control over the costs of these items must be approached by determining how much each of these items should cost in total for a period such as a month or week. A list of overhead costs showing the allowed amounts of each overhead item for a specified period is ordinarily called a budget rather than a standard. Such a budget is illustrated in Figure 96. In this statement the budget allowances for the current month are given in the column headed "Making a Total for the Month" and the amounts allowed for the year to date are shown under the heading "So Far This Year Your Budget Has Allowed."

In order that the foreman in charge of the department may know how successful he has been in keeping the overhead of his department within the budget, he is given a statement of this type each month. By comparing the actual overhead which is shown in adjacent columns with budgeted overhead, he can readily determine where he stands. A copy of this same statement also goes to the factory manager to keep him informed of the performance of his foremen.

Placing Responsibility for Overhead. Costs are controlled by individuals who take action to prevent waste or excessive use of labor, materials, and services. For this reason costs are grouped by departments or cost centers in which they are controlled and the supervisor in charge of the department or center is held responsible for these costs. A budget is prepared for each department, giving the name of the person responsible, listing the costs which are to be controlled, and the amounts budgeted for the period. In this way costs which each supervisor can control are assigned to him and by comparing actual costs incurred with budgeted costs, individual cost control performance is measured.

In preparing departmental budgets it is important to separate those costs which are controllable by the department head from those costs which the individual department head does not control. The budget illustrated in Figure 96 lists first those costs which are controllable by the foreman of the department because he has authority to say how many employees are employed in his department as assistant foremen, instruc-



DEPARTMENTAL OVERHEAD

Mr. Charles C. Logan
DEPT. 112 Machine Shop For the Period Ended Apr. 30, 19 –

STANDARD MINUTES OF PRODUCTION		MONTH		YEAR TO DATE	
	ESTIMATE	800,000		3,406,500	
	ACTUAL	820,200	103%	3,412,800	100%

THESE ARE ITEMS UNDER YOUR DIRECT CONTROL	FOR WHICH YOU ARE ALLOWED		Making A Total For The Month Of	You Actually Spent	SO FAR THIS YEAR	
	Per Month	Per 1000 Std. Mins.			Your Budget Has Allowed	You Have Spent
E3 Assistant Foremen	$ 325	$ .50	$ 735	$ 763	$ 3,006	$ 3,115
E40 Supervision	500	1.80	1,976	1,904	8,143	8,017
E41 Instructors		.06	49	25	205	246
E4 Clerical	210	.15	333	409	1,352	1,580
E6 Trucking		.32	262	252	1,092	1,103
E16 Cleaning Machinery & Equipment		.40	328	307	1,365	1,314
E32 Tool Crib	175	.08	241	220	973	912
E35 Special Investigation		.02	16	22	68	65
E14 Overtime Bonus				12		33
E43 Indirect Premium		.27	221	214	921	901
E30 Rework Labor		.36	295	413	1,229	1,318
Other Indirect Labor				3		96
TOTAL INDIRECT LABOR			4,456	4,544	18,354	18,700
E13 Metered Gas & Electricity	40	.01	48	45	194	198
E159 Tel. & Tel.	8		8	8	32	35
E20 Supplies		2.30	1,886	2,120	7,849	7,746
E22 Replacement Tools		2.50	2,051	1,892	8,532	9,227
E25 Scrap		1.60	1,312	1,714	5,460	5,910
E30 Excess Tool Cost						
E61 R. & M. of Machinery		1.15	943	644	3,925	3,129
E80 R. & M. of Tools		2.10	1,722	1,781	7,167	7,355
Other R. & M.	25	.70	599	555	2,489	2,334
TOTAL SUPPLIES & CHARGES			8,569	8,759	35,648	35,934
TOTAL CONTROLLABLE OVERHEAD			13,025	13,303	54,002	54,634
Your expenses were (more) - less than allowed by				(278)		(632)
In addition, your department is charged with these expenses not subject to your direct control						
New Tools				1,625		7,507
Unmetered Gas & Electricity				34		130
Employee Insurance & Taxes				1,826		7,913
Vacation & Hourly Holiday Pay				1,200		4,800
Other charges covering depreciation, heat, rent, etc.				6,332		25,328
This total is the complete direct expense of operating your department				24,320		100,312

FIGURE 96. Departmental Overhead Budget

tors, and clerks. Likewise he is directly responsible for control of such costs as supplies, replacement tools, scrap, repairs, and maintenance. At the bottom of the list are grouped costs applicable to the department but not controlled directly by the foreman. Thus the foreman does not make decisions to purchase new tools, to provide paid vacations for employees, and to acquire plant and equipment entailing charges for depreciation or rental. These decisions are made by major executives of the company in most cases. The superintendent in charge of the power plant is usually responsible for costs of lighting and heating and hence these costs appear as controllable in his budget, but not in budgets of foremen whose departments consume these services. In general, someone in the organization should be responsible for every cost and hence every cost must appear as controllable in someone's budget.

Costs listed at the bottom of the budget illustrated are, however, part of the costs of operating the department and are properly included in establishing the standard overhead rate used for costing production in the department. Separation from the other costs is purely for the purpose of establishing responsibility for cost control.

Controlling Overhead Charges Under Conditions of Fluctuating Volume. Many companies find that their sales fluctuate seasonally with the trends and cycles of their industry, and perhaps also for other reasons. To some extent it may be possible to keep the factory running at a steady rate by producing for stock in periods of slack sales, but this practice may be limited by lack of working capital, lack of storage space, and by the danger that goods will become unsalable or that losses will be incurred from declining prices. Hence factory production very commonly fluctuates considerably over a period of several months.

Changes in factory activity affect many of the overhead costs. For example, in the departmental budget illustrated in Figure 96, the allowance for supplies is $1,886 for the month of April, based upon actual production of 820,200 standard minutes of work and an allowance of $2.30 per thousand minutes. If the same department had operated at a rate of 960,000 standard minutes per month (or at 120% of standard volume) the allowance for supplies would have been $2,208. On the other hand, had production been only 640,000 standard minutes (or 80% of standard volume) the amount allowed for supplies would have been $1,472. In other words, when the rate of production in the department increases, it is to be expected that a greater quantity of supplies will be needed. In the same manner, the quantity of supplies consumed should be reduced when the volume of production declines. In this case it has been determined that supplies costing $2.30 will be needed for each thousand standard minutes produced by Department 112. By multiplying this figure by the actual production, the budget allowance for the period is readily determined.

Behavior of Overhead Costs with Changes in Volume. Factory overhead is made up of variable, semivariable, and fixed costs. Perfectly variable costs are those costs which change proportionately with changes in production. Fixed costs do not change in amount with changes in output for a given period covered by a budget. Semivariable costs display characteristics of both fixed and variable costs, for they can be analyzed into a minimum amount which does not vary with volume and a variable component which does change with volume. Thus, when activity drops, variable costs should be curtailed sufficiently to prevent an increase in unit variable cost, but since fixed costs cannot be reduced for a temporary drop in activity, the unit fixed cost rises. Unless these two kinds of overhead are separated, it is impossible to determine whether an increase in unit cost is due to an unavoidable increase in unit fixed cost or to failure to control the total variable costs.

Consideration must be given to the behavior of costs under conditions of changing volume, for otherwise it is not possible to determine how much the costs should be in a given period. This is accomplished by setting standards which, for each cost, have two components, namely, a fixed amount per month and an amount per unit of production. These standards are illustrated in the first two columns of Figure 96. For example, the amount allowed for salaries of assistant foremen is $325 per month plus $.50 per 1,000 standard minutes produced in the machine shop. In some cases the cost is wholly variable and therefore has no fixed component. Other costs are wholly fixed and have no variable component. Again referring to Figure 96, both types of costs are represented by costs for instructors and for telephone and telegraph respectively. Such standards are called *flexible standards* since they express each cost as a function of production volume.

Flexible Budgets. By the use of flexible standards it is possible to prepare a departmental budget for any volume of production which may occur. In Figure 96 budgets have been set by this method both for the month of April and for the year to date, based upon production of 820,200 standard minutes of work in April and 3,412,800 standard minutes in the four months ending on April 30. Taking the first cost as an example, allowances are established as follows:

Budget allowance for April for assistant foremen:

$$\$325 + (820.2 \times \$.50) = \$735$$

Budget allowance for year to date for assistant foremen:

$$(\$325 \times 4) + (3{,}412.8 \times \$.50) = \$3{,}006$$

Budgets which are prepared in this manner are called *flexible budgets* since the allowances have been adjusted to the volume of production by use of flexible cost standards. The terms "variable budget" and "sliding budget" are also used with similar meaning.

Budgets like that shown in Figure 96 are in practice prepared for all departments in the factory. In each case flexible standards are established for every overhead cost because in this way it is possible to determine what the cost allowance should be for whatever volume of production the individual departments turn out during a given month.

Flexible Budgets in Columnar Form. Flexible budgets are sometimes prepared in a form which differs from that previously illustrated. This second type of flexible budget is shown in Figure 97. Since allow-

BUDGET OF MANUFACTURING OVERHEAD

MACHINE DEPARTMENT 1

Direct Labor Hours	2,500	3,000	3,500	4,000	4,500	5,000
Per Cent of Capacity	50	60	70	80	90	100
Expense Items						
Supervision	$ 160	$ 160	$ 160	$ 200	$ 200	$ 200
Clerical	100	100	100	120	120	120
Stock Handlers	80	90	100	110	120	130
Cleaners	60	60	60	60	60	60
Overtime	-0-	-0-	-0-	40	100	250
Total Indirect Labor	$ 400	$ 410	$ 420	$ 530	$ 600	$ 760
Employees' Service	$ 350	$ 415	$ 480	$ 555	$ 625	$ 700
Office Supplies	$ 10	$ 10	$ 10	$ 10	10	$ 10
Shop Supplies	40	50	60	70	80	90
Nondurable Tools	150	175	200	225	250	275
Power and Steam	20	30	40	50	60	70
Maintenance	1,200	1,250	1,300	1,350	1,400	1,450
Total Supplies	$1,420	$1,515	$ 1,610	$1,705	$1,800	$1,895
Works Administration	$ 100	$ 100	$ 100	$ 100	$ 100	$ 100
Works Accounting	250	250	250	250	250	250
Cost Estimating and Standards	200	200	200	200	200	200
Scheduling	100	100	100	100	100	100
Personnel	150	150	150	150	150	150
Total Service Dept. Chgs.	$ 800	$ 800	$ 800	$ 800	$ 800	$ 800
Depreciation	300	$ 300	$ 300	$ 300	$ 300	$ 300
Rent	400	400	400	400	400	400
Taxes and Insurance	30	30	30	30	30	30
Total Fixed	$ 730	$ 730	$ 730	$ 730	$ 730	$ 730
Total All Expenses	$3,700	$3,870	$ 4,040	$4,320	$4,555	$4,885
Rate per Direct Labor Hour	$1.48	$1.29	$1.15	$1.08	$1.01	$ .98

FIGURE 97. Flexible Budget in Columnar Form

ances are set up in columns, this is called the columnar form of flexible budget. In practice, the allowances for the actual volume of production are determined by taking the figures from the appropriate column. When the production volume figure for which the budget is being prepared falls between volumes listed in the table, cost allowances are set either by taking the nearest available figures or by interpolation. For example, assume that Machine Department 1 worked 4,200 direct labor hours in April and that the budget allowances are to be determined. Allowances for costs in the indirect labor group may be taken either from the column headed 4,000 hours or may be set as follows:

Expense Item	Budget Allowance for 4,200 Hrs.
Supervision	$200.00
(No change occurs in the amount indicated by the columnar budget between 4,000 and 4,500 hrs. Hence the allowance is $200.)	
Clerical	120.00
(See explanation above.)	
Stock Handlers	114.00
[This cost increases from $110 at 4,000 hrs to $120 at 4,500 hrs., or by $10. Expressed in terms of cents per hour, this cost changes at a rate of $\frac{\$10}{500\text{ hrs.}}$ or $.02 per hour. If the allowance for 4,000 hrs is $110, the allowance for 4,200 hrs. is $110 + (200 hrs. × $.02) = $114]	114.00
Cleaners	60.00
(See explanation under Supervision.)	
Overtime	64.00
$\$40 + \left(\frac{\$60}{500} \times 200\right)$	
Idle Time	none
Total Indirect Labor	$558.00

Allowances for the remaining costs are calculated in the same manner.

Determining How Costs Vary With Volume. The preceding pages have shown how flexible cost standards are employed to prepare flexible budgets as an aid to control of factory overhead costs. It has been seen that these flexible cost standards are based upon determination of the rates at which costs should change with changes in production volume of each department. The procedures for determining how costs should vary with volume or, in other words, how the flexible cost standards are set, remain to be explained.

It may be seen from the budgets illustrated that some costs are expected to change considerably with changes in volume whereas other costs change little or not at all. Thus in Figure 96 the amount allowed for supplies doubles when production increases 100%; supervision cost increases by 26%; and telephone and telegraph does not change at all. The reason for this is that individual costs vary differently with changes in volume. There are three methods for determining how costs vary with volume, viz.

1. Scanning the chart of accounts to pick out fixed and variable costs
2. Analysis of past experience to determine how costs have varied with volume
3. Industrial engineering analysis of operations to determine how costs should vary with volume

Scanning the Chart of Accounts. From a knowledge of the business it is usually possible to classify some costs as fixed and others as variable. For example, property taxes are usually fixed whereas direct material is practically always a variable cost. By scanning the company's chart of accounts a number of the accounts can thus be classified as fixed or variable. However, in using this method it is important to remember that it is not possible to say whether a given cost is fixed or variable without knowing in considerable detail the conditions under which the cost is incurred. For example, salesmen's compensation is fixed if the salesmen are paid an annual salary but variable if they work on a straight commission basis. Depreciation, a cost usually classified as fixed, may be variable if the life of the machines is determined by the units of production method rather than by a fixed charge per period. On the other hand, direct labor cost is usually classified as variable but might be fixed where an annual guaranteed wage is in effect.

At best there is always a considerable number of accounts which cannot be classified by this method because more study is needed. Hence this method is useful primarily to reduce the number of accounts which must be analyzed in detail.

Analysis of Past Experience. The manner in which costs have varied with changes in volume can be studied by analyzing past experience represented by costs which have been recorded in the accounts of previous periods. Simple methods of correlation analysis are ordinarily employed for the purpose.

The first step is to plot the costs on a scatter chart. Cost figures plotted should be those recorded in a period which is not unduly affected by abnormal conditions such as a war. Data should cover a range of volume which is wide enough to include both the lowest and highest volumes likely to be experienced in the near future. Since the objective is to prepare monthly budgets in most cases, cost and volume figures should be plotted by months. Construction of the chart proceeds as follows:

Assuming that supervision cost in a given department is to be analyzed, the data given below are first obtained from records of past operations.

Period		Volume of Production (in Direct Labor Hours)	Amount of Cost
Number	Date		
1	1952 Jan.	16,000	$2,100
2	Feb.	14,000	1,900
3	Mar.	12,000	1,800
4	Apr.	8,000	1,300
5	May	10,000	1,400
6	June	12,000	1,600
7	July	16,000	2,100
8	Aug.	20,000	2,600
9	Sept.	25,000	3,200
10	Oct.	30,000	3,900
11	Nov.	30,000	3,900
12	Dec.	26,000	3,500
13	1953 Jan.	22,000	3,000
14	Feb.	20,000	2,800
15	Mar.	18,000	2,300
16	Apr.	20,000	2,400
17	May	22,000	2,600
18	June	25,000	2,900
19	July	25,000	2,900
20	Aug.	26,000	3,000
21	Sept.	24,000	2,900
22	Oct.	23,000	2,900
23	Nov.	21,000	2,600
24	Dec.	24,000	3,000

The above figures are then plotted in the form of a scatter chart as shown in Figure 98. On this chart, the horizontal axis represents volume which is measured by direct labor hours in this case, although some other unit such as number of pieces produced might be used under appropriate circumstances. The vertical axis represents the cost in dollars. Points on the chart are numbered in chronological order for easy identification.

A straight line is then drawn through the points in such a way that it represents the trend of the points. This line, known as the budget line, is sketched in by inspection, using a transparent straight edge or a string stretched between two pins as a guide. The cost line may be fitted to the points by the method of least squares if it is desired to use more refined mathematical procedures. However, the visual method described above is the one generally used in practice because it is simple and yields results sufficiently accurate for the purpose. This line represents the path along which costs move with changing volume. By reading from the chart, the indicated amount of supervision cost may be determined for any volume within range of the chart. For example, at 18,000 hours, supervision cost is $2,300.

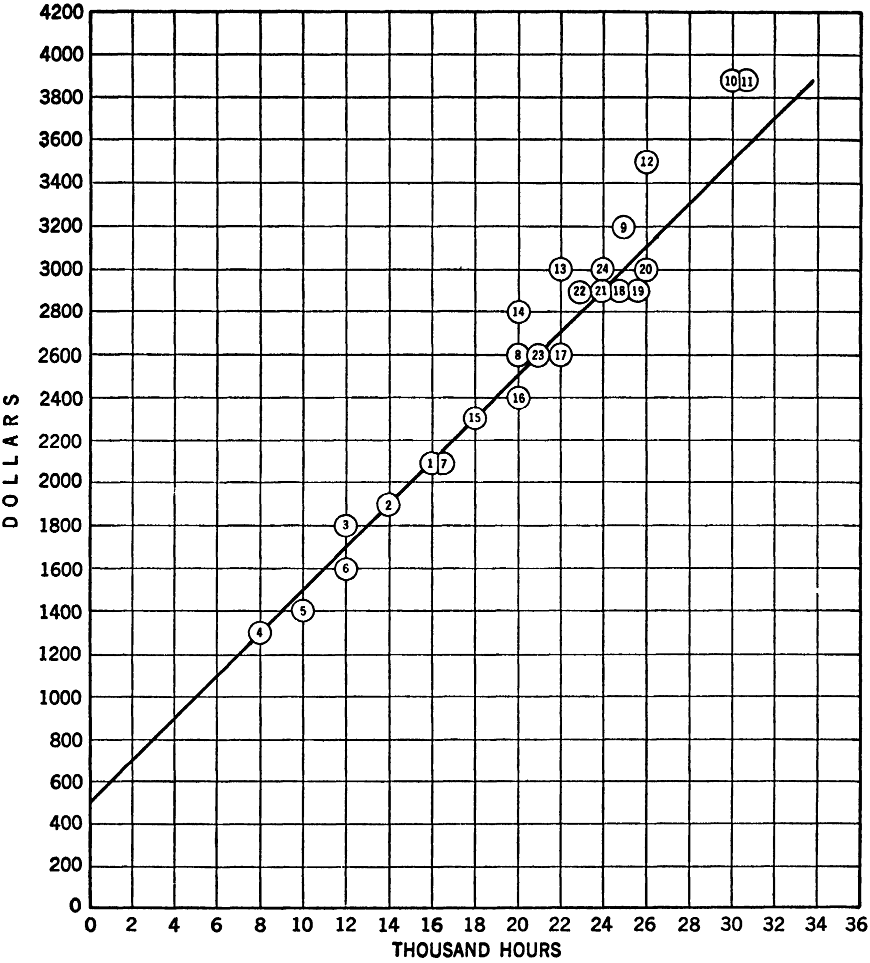


FIGURE 98. Determination of Fixed and Variable Components of Supervision Costs

Determining Fixed and Variable Components. When the cost line on the chart in Figure 98 is projected to the left until it crosses the vertical axis of the chart, the indicated fixed portion of the cost is obtained. Reading from the chart, the fixed cost is thus found to be $500 per month. This is the amount of cost which is necessary to have the plant *ready* to operate. The amount of variable cost at any given volume can be determined by reading the total cost from the chart and then subtracting the amount of fixed cost. For example, at a volume of 20,000 hours, total cost is $2,500. Subtracting the $500 fixed component leaves total variable costs of $2,000, or $.10 per direct labor hour. The fact that a portion of the cost does not change with varying volume results from the presence of some employees who are retained on the payroll even during temporary shutdowns. The variable portion of the cost represents wages of employees who work more hours in this department as volume increases or fewer hours as volume decreases.

The cost line on the chart may also be expressed as a formula. For example:

Supervision cost = \$500 (fixed) + \$.10 per direct labor hour (variable)

When this formula is known, the total amount of the cost can be calculated more easily than it can be read from the chart. Thus, if it is desired to determine the cost of supervision in this department when the hours worked are 18,000, it is necessary only to substitute the number of hours worked in the above formula:

Monthly supervision cost = \$500 + (\$.10 × 18,000) = \$2,300

The two terms in the above formula, viz., the amount of fixed cost and the rate at which the variable component of the cost varies with production volume, are the items needed to set a flexible standard cost. By reference to Figure 96, it is seen that the column of flexible cost standards consists of a fixed amount per month and a rate expressed in dollars per 1,000 standard minutes for each overhead item.

Significance of Arrangement of Points on Chart. The chart illustrated in Figure 98 shows the typical appearance of a semivariable cost. If the cost were wholly fixed within the range of production charted, the cost line would parallel the horizontal axis. On the other hand, a wholly variable cost would begin at the origin (i.e., where both cost and volume are zero) and slope upward with increasing volume.

In practice the points on a scatter chart usually do not lie on a straight line. The tendency to be scattered along a definite trend line is often much less evident than the chart illustrates. At times the points are scattered in a random fashion so that little or no relationship between cost and volume can be discerned on a chart. Various irregularities such as steps or breaks in the cost line are also frequently observed. These situations result from the fact that volume is only one of several different factors which may have affected costs during the period charted. Allowance for these factors must be made and the proper cost line established before the line can be used as the basis for a flexible cost standard. Succeeding paragraphs describe this process of correction for several common factors.

Changes in Prices of Cost Factors. If prices of supplies and services and wage rates have changed to an important extent during the period covered by the costs being studied, it is necessary to adjust all costs to the same price level. Prices used should be those anticipated in the coming period. The adjustment is made by extending quantities at expected prices and wage rates, or, where this is not practical, by multiplying costs of previous periods by a ratio measuring the change in prices. For example, if wages have risen by 10% since last year, labor cost figures of the previous year should be multiplied by 110% before charting.

Changes in Plant and Equipment. The behavior of costs under conditions of fluctuating volume is often changed materially when new and different equipment is installed. For example, the installation of a conveyor belt to replace hand trucking decreases the cost of indirect labor while at the same time it results in additional fixed costs for depreciation, property taxes, and insurance. Where such changes have been made the figures charted should be limited to the period since the new equipment was installed.

If previous experience is not available, operating costs at two different volumes (preferably chosen to represent the lowest and highest volumes likely to occur) can be estimated. From these figures cost standards can be set as follows: [1]

(1) *Determining variable cost rate*

	Monthly Volume in Direct Labor Hours	Cost for Indirect Labor
High volume	60,000 hrs.	$3,820.00
Low volume	10,000 hrs.	1,970.00
Difference	50,000 hrs.	$1,850.00

$$\text{Variable cost rate} = \frac{\$1,850}{50,000} = \$.037$$

(2) *Determining monthly fixed cost*

	Low Volume	High Volume
Total indirect labor costs	$1,970.00	$3,820 00
Variable cost at $.037 per direct labor hour	370.00	2,220.00
Monthly fixed cost	$1,600.00	$1,600.00

Other Influences Affecting Costs. Numerous other factors may have been present to change the relationship between costs and production volume. Among these are changes in products made, in methods of manufacturing, in company organization, in laws affecting working hours and conditions, and in efficiency of employees and supervisors. All of these tend to obscure the correlations obtained when costs experienced in previous periods are charted as described above. For this reason, it is often necessary to disregard the experience of certain periods and to limit the costs studied to recent periods in which conditions have been similar to those expected in the near future. It must always be remembered that the objective is to determine how costs should vary with volume in the coming budget period; therefore, past experience is useful only to the extent that future conditions are likely to be similar to those which prevailed in the past.

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[1] From Charles H. Gleason, "The Profit-Volume Relationship," *N.A.C.A. Bulletin,* July 1, 1947, p. 1335.

If costs have not been well controlled in the past—and they usually have not where standards have not been in use previously—the historical figures include the results of considerable inefficiency. Standard costs based upon such past costs are accordingly excessive. Some evidence of lack of cost control can be seen in the chart illustrated in Figure 98. This chart shows that supervision cost has been rather closely controlled during the first seven months (points 1-7) when volume was low; with a substantial increase in production in the next four months (points 8-11) costs were allowed to rise more than proportionately to output, and when volume again dropped (points 12-14) costs remained high. This is quite typical, for where costs are not well controlled they tend to rise rapidly with expanding output and then to lag as volume decreases again. Apparently the management observed this, for the costs took a decided drop in the fifteenth month and then continued low during the remainder of the period covered. In drawing the line which fixes the standard variable expenditure for supervision, points 8-14 have been disregarded because they represent excessive expenditures. For reasons such as this, the position of the cost line which establishes cost standards is often determined as much by judgment of the person setting the standards as by mathematical analysis of previously recorded figures.

Choice of Unit for Measuring Volume. The unit chosen for measuring volume of production for purposes of budgeting costs must reflect changes in activities which cause costs to vary. Where a single product of uniform characteristics is being processed, it may be possible to measure production in pieces, in pounds, or in some similar unit. For example, in manufacturing perforated acoustic ceiling squares, holes are drilled in previously cut squares of wallboard. Volume of production in the drillpress department is measured by the number of square feet of product produced. On the other hand, in the shipping department where a variety of products are packed, costs vary with the number of man hours worked. Here they do not vary with the number of square feet because large sheets of wallboard require relatively little labor to prepare for shipment whereas small squares of acoustic material require careful packing in cartons. Companies which have automatic or semi-automatic machines often measure volume in terms of machine hours because the number of employees needed to operate such equipment changes but little with changes in output of the machines. Under these conditions costs tend to vary with the number of hours the machines are run rather than with the number of man hours worked in the department. Failure to use the proper unit for measuring volume often produces a scatter chart on which little or no evidence of correlation between cost and production volume can be seen. By trying several different units, it is sometimes possible to obtain distinct improvements in the correlations obtained.

Standard hours are usually preferable to actual hours for measuring volume because the standard hour represents the amount of work accomplished while the actual hour represents the number of hours worked regardless of whether or not anything was accomplished. For example, an employee performs an operation on a certain component part for an adding machine. The standard calls for production of 100 pieces per hour. If the employee works eight hours and produces 1,000 pieces, his production in terms of standard hours is calculated by dividing the standard number per hour into the total number produced in the day, or $1{,}000 \div 100 = 10$ standard hours. As a measure of production, standard hours is here preferable to actual hours. Use of actual hours rather than standard hours may result in increasing budget allowances when production per hour declines. Ordinarily this is not desirable.

Engineering Analysis of Cost Variation with Volume. As stated earlier, rates of cost variation based wholly upon past experience can be projected into the future only when conditions are essentially the same as they have been in the past. Moreover, too heavy a reliance on past experience in setting flexible budget standards tends to perpetuate past inefficiencies when the emphasis should be upon finding ways to reduce costs. For these reasons, past experience is generally supplemented by direct engineering study of requirements for manpower, supplies, and services at different volumes of production. Usually the company's industrial engineering staff is primarily responsible for the work.

This approach to the setting of flexible cost standards comprises study of the operations of each department to ascertain how many employees are needed and what supplies and services should be consumed at each of several volumes of production. The number of people required under the classification of indirect labor (e.g., assistant foremen, toolcrib attendants, and timekeepers) is listed and decisions are made as to how many employees in each classification should be added or removed when production volume increases or decreases. Data resulting from such studies are assembled on schedules like those illustrated in Figures 99 and 100.

It is always advisable to have foremen and supervisors work with the engineering staff in developing the budget standards. These employees can often give valuable assistance based upon their familiarity with the manufacturing operations involved. By consulting them or giving them an opportunity to approve the standards for which they will subsequently be held responsible, it is easier to obtain their cooperation in effecting control of costs.

MANPOWER BUDGET
DEPARTMENT 6—ASSEMBLY
FOR MONTH OF ——— 19—

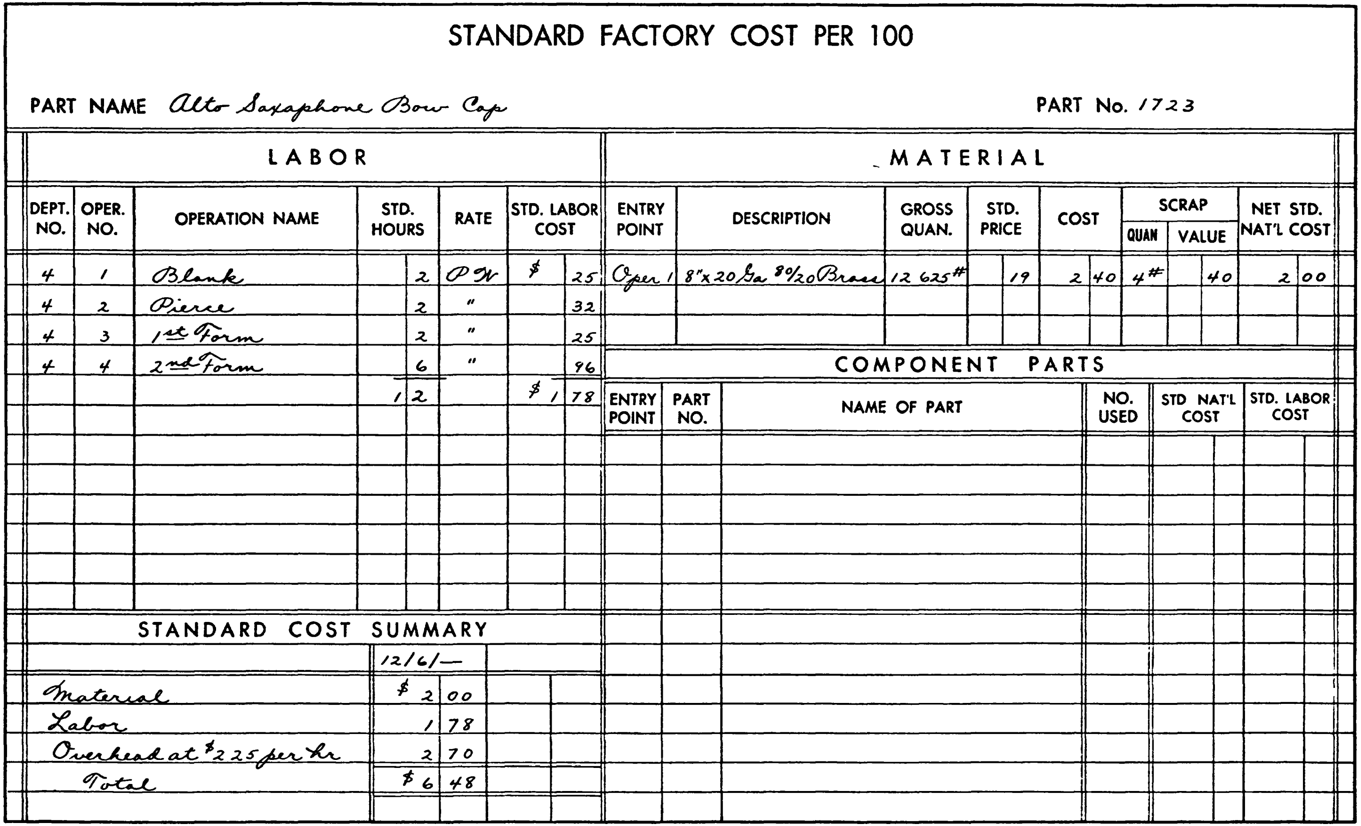
	Budget Basis	Standard Force Requirements	Financial Allowances to Reconcile with Financial Budget
Productive Forces	Manufacturing Schedule	50	$x.xx Per Allowed Hour
Indirect Force Standards			
Supervision	Fixed Personnel—2		Fixed—$xxx Plus
	Balance—1 for 25 Operators	4	$xxx Per Month Per Variable Employe
Clerical—Hourly	1 for 50 Operators	1	$x.xx Per Allowed Hour
Laborers	1 for 25 Operators	2	$x.xx Per Allowed Hour
Sweepers	Floor Area	1	$x.xx Per Allowed Hour
Setup	Scheduled Setups	3	$x.xx Per Allowed Hour
Inspection	1 for 25 Operators	2	$x.xx Per Allowed Hour
Total Indirect Labor		13	
Tool Repair	Tool Usage (Std Route Sheet)	1	$x.xx Per Allowed Hour
Oilers	Machine Operating Hours	1	$x.xx Per Allowed Hour
Machine Repairs	Machine Operating Hours	3	$x.xx Per Allowed Hour
Total Maintenance Labor		5	
Product Salvage	Manufacturing Schedule	1	$x.xx Per Allowed Hour
Total Nonproductive		19	

FIGURE 99. Manpower Budget

OPERATING SUPPLIES BUDGET
DEPARTMENT 1—MACHINING
FOR MONTH OF ——— 19—

	Budget Basis	Requirements	Financial Allowances to Reconcile with Financial Budget
Lubricating Oil ..	Machine Operating Hours	25 gals.	$ .xx per gal.
Cutting Compounds	Machine Operating Hours	350 gals.	.xx per gal.
Wiping Towels	Per Employe	2,500	.xx each
Paper Towels	Per Employe	100 rolls	.xx per roll
Gloves .	Per Employe	100 pair	.xx per pair
Goggles .	Per Machine	10	x.xx each
Aprons .	Per Employe	15	x.xx each
Safety Shoes	Per Employe	5 pair	x.xx per pair
Brooms .	Floor Space	3	.xx each
Cleaning Brushes	Floor Space	15	.xx each
Cleaning Compound	Floor Space	100 lbs.	.xx per lb.
Sawdust	Floor Space	150 lbs.	.xx per lb.
Washing Compound	Machine Operating Hours	100 gals.	.xx per gal.
Slushing Compound	Machine Operating Hours	50 gals.	.xx per gal.
Emery Cloth	Machine Operating Hours	500 sheets	.xx each

FIGURE 100. Operating Supplies Budget



STANDARD FACTORY COST PER 100

PART NAME Alto Saxaphone Bow Cap

PART No. 1723

LABOR

DEPT. NO.	OPER. NO.	OPERATION NAME	STD. HOURS	RATE	STD. LABOR COST
4	1	Blank	2	PW	$ 25
4	2	Pierce	2	"	32
4	3	1st Form	2	"	25
4	4	2nd Form	6	"	96
			12		$ 1 78

MATERIAL

ENTRY POINT	DESCRIPTION	GROSS QUAN.	STD. PRICE	COST	SCRAP QUAN	SCRAP VALUE	NET STD. NAT'L COST
Oper 1	8"x20 Ga 80/20 Brass	12 625#	19	2 40	4#	40	2 00

COMPONENT PARTS

ENTRY POINT	PART NO.	NAME OF PART	NO. USED	STD NAT'L COST	STD. LABOR COST

STANDARD COST SUMMARY

	12/6/—
Material	$ 2 00
Labor	1 78
Overhead at $2 25 per hr	2 70
Total	$ 6 48

FIGURE 101. Standard Cost Sheet

Application of Flexible Cost Standards. When the flexible standards have been established, each foreman or supervisor is provided with a copy of the standards which apply to his own department. In addition, the foreman should receive a copy of the production schedule for his department at the beginning of each month or as far in advance as possible. Knowing the volume of production which he is expected to turn out, he can then plan his operations in order to meet the cost standards which have been set. In doing this, he makes use of the manpower schedules illustrated.

At the end of the month, the factory accounting department prepares a budget statement showing how actual costs compare with the budgeted costs. This statement is illustrated in Figure 96. The method for arriving at the budget allowance columns has already been described. Actual costs are taken from the accounts in the factory ledger.

Relationship Between Flexible Budgets and Standard Overhead Rates. The standard overhead rate employed for costing production of a department is, as stated earlier, determined by dividing the standard volume of production into the amount of overhead cost incurred at that volume. The latter figure is simply the amount of overhead determined by setting up a budget for the standard volume, using the flexible standards for each item. Actual production for the period is then multiplied by the above standard rate in order to determine the amount of overhead to be applied to production. If the actual quantity of production differs from the standard volume, the actual amount of overhead cost will differ from the amount applied. Likewise, if the actual amount of expense is greater or less than the amount budgeted there will be some over- or underabsorption of overhead cost. These differences constitute the overhead variance.

Standard Cost Sheet. For each product and for each component of each product, a standard cost sheet is set up (Figure 101). As soon as the standard quantities and related standard costs have been determined, the information is posted to a standard cost sheet. The form shows the quantity, unit and total costs for material. In the illustration the scrap value is estimated and a net standard material cost is arrived at. In the case of labor each operation is shown together with the proper time allowance, the hourly or piece work rate, and the total labor cost. In Figure 101 the overhead is applied as a blanket rate per hour, although departmental rates are preferable.

QUESTIONS

1. The basis upon which fixed overhead should be absorbed may be practical capacity, average capacity to make and sell, capacity to produce considering bottleneck departments, or capacity to sell. Explain the significance of the choice to be made in recommending the installation of a system of standards for a manufacturer of men's shirts.
2. With reference to Question 1, show how a decision with regard to standard capacity may be substantially affected by market conditions such as severe competition and a prospect of decreasing prices.
3. References are often made in financial papers to companies operating at 105% of capacity. How is this possible?
4. Differentiate between a fixed budget and a flexible budget for manufacturing overhead.
5. What essential information must be available in order to develop a flexible budget?
6. Of what importance is historical cost information in the preparation of flexible budgets?
7. The use of the scatter chart in isolating fixed and variable components of manufacturing overhead assumes a straight line relationship between the item of overhead and the level of output. Can you defend the assumption of this relationship?
8. Prepare a scatter chart for the following overhead item which is related to labor hours:

Overhead	Labor Hours
$1,380.00	14,200
1,700.00	17,400
1,600.00	17,800
1,380.00	17,600
1,560.00	18,200
1,580.00	18,000
1,620.00	17,800
1,600.00	19,000
1,880.00	18,800
1,840.00	19,200
1,820.00	18,000
2,200.00	20,000

9. From the following information derived from the records of the Zedor Company determine the fixed and variable components for indirect labor:

Month	Direct Labor Hours	Indirect Labor Cost
January	500 hrs.	$480.00
June	900 hrs.	$864.00

10. Discuss the conditions under which it would be necessary to revise the manufacturing overhead budget.

11. Experience of the A B Company shows the following:

Year	Direct Labor Hours Operated
1942	20,000
1943	35,000
1944	52,000
1945	48,000
1946	40,000
1947	45,000
1948	28,000
1949	40,000
1950	45,000
1951	48,000

During this period practical capacity of the plant remained unchanged at 50,000 direct labor hours per year. A forecast for 1952 indicates operations at a rate of 60,000 hours after allowing for additions to plant which will make possible operation at 70,000 hours a year.

What volume should be selected for purposes of establishing a standard overhead rate? Give reasons for your choice.

12. In 1946 the sales department for a manufacturer of auto batteries prepared an estimate which showed that the company could readily sell 600,000 batteries a year in one of its sales territories. The plant which served this territory had a capacity of only 100,000 a year and hence a new plant having a capacity of 500,000 batteries a year was built. The full production of this plant was sold readily until 1949 when sales dropped to 150,000. A survey of the market then showed that the company's portion of total battery sales in the territory had risen from 10% before the war to 40% after the new plant was built. This was explained by the fact that competitors had not increased production capacity and the company had therefore obtained a larger share of the market. However, the accumulated postwar demand for batteries had now been satisfied, total battery sales in the area appeared to have stabilized at about 150% of the 1940-41 level. What effect is this condition likely to have on the company's costs?

Chapter 18

VARIANCE ANALYSIS

Checking Performance Against Standards. Having determined a proper standard cost for any given article, the executive may dismiss the question of cost from his mind until such time as there is a discrepancy between the actual and standard cost. It is the prime function of the cost accountant to draw the attention of the operating executive promptly to the existence of such discrepancy or variation. When a significantly large cost variation appears, management should be able to analyze it and determine where it occurred, who was responsible, and why it happened. This analysis requires that cost records show in what department the variation occurred; then from a knowledge of the organization, the person responsible is located, and physical inspection shows the cause of the variation.

The process of currently checking actual performance against standards is the function of the inspection department which carries out comparisons with physical standards and of the cost accounting department which collects and classifies the data for comparison of actual with standard costs.

From these two departments, but chiefly from the latter, come reports summarizing the results of performance as measured against standards, in order that executives may be currently informed concerning the work over which they have authority and for which they are responsible. In comparing actual with standard costs use is made of the principle of exceptions referred to in an earlier chapter. It is understood that variances from standard costs cannot, by themselves, control costs. Instead the variances are only figures which tell how close actual costs have been to standard costs. The real action which controls costs must be taken by those individuals who supervise operations in the factory.

Analysis of Variances. Since the total difference between the actual and standard cost is composed of variances arising from a variety of causes, it is necessary to resolve this total into its component parts in such a way that the contribution of each causal factor can be isolated. This is accomplished by taking the factors one at a time, while assuming that the other factors are held constant. Thus it is possible to calculate the influence upon cost of each cause of variation.

The results are affected by the kind of standard in use. If, for example, ideal standards are used, the variances cannot be entirely eliminated, and management must decide how much of the variance represents avoidable inefficiency and how much is merely human inability to attain maximum efficiency. The part ascribable to the former cause is the responsibility of someone within the organization, but the second cannot be treated in the same way.

Determining Variances at the Source. Control over costs is best exercised through action at the source of the cost. Thus the quantity of material used must be controlled at the point in the factory where the materials are used. Labor performance is best controlled at the place and time where the operations to be controlled take place. On the other hand, price and quality of materials are most effectively controlled at the time the materials are purchased. Knowledge of variances is most useful in controlling costs when the actual costs are compared with standard costs and variances reported to the person responsible as soon as possible after the work has been done. For this purpose, variance reports are prepared by summarizing material requisitions, scrap and spoilage reports, job time tickets, and similar source records. Ordinarily it is too late for the variance reports to be most effective if they are prepared after the monthly closing. For this reason variance reports covering material and labor are often prepared daily or weekly. Furthermore, the reports are not drawn off from the accounts, but are made up directly from the source records before the latter have been posted to the accounts.

Analysis of Cost Variances

Direct Material Variances. Differences between standard and actual cost of direct materials may result from (1) paying a price for material which is above or below the established standard price, and (2) using more or less than the standard quantity of material for the number of units of product made. These variances are called direct material price variance and direct material usage variance, respectively. The definitions may be expressed as formulas as follows:

Material price variance = Actual quantity × (Standard unit cost — Actual unit cost)
Material usage variance = Standard unit price × (Standard quantity of material in product — Actual quantity of material used)

Material Price Variance. Material price variances may be caused by (1) fluctuations in market prices of materials; (2) purchasing in nonstandard lots; (3) purchasing from unfavorably located suppliers, thereby incurring additional transportation costs; (4) excessive shrinkage or losses in transit; (5) payment of additional charges for special handling or faster transportation; (6) purchasing from suppliers other than those offering most favorable terms; or (7) failure to take cash discounts available. When the material price variance is large, it may be desirable to analyze it according to these causes. By reference to invoices and perhaps consultation with the purchasing department, the principal causes and amount of variance resulting from each can be determined.

The computation of material price variances may be illustrated from a purchase invoice showing the following data:

1,000 wooden boxes—Specification No. X-102 @ .55	$ 550.00
5,000 wooden boxes—Specification No. X-103 @ .35	1,750.00
2,000 wooden boxes—Specification No. X-107 @ .60	1,200.00

By reference to the list of material price standards, the standard prices of these items are found to be $.50, $.30, and $.60 respectively.

Item	Standard Cost	Actual Cost	Price Variance
X-102	$ 500.00	$ 550.00	—$ 50.00*
X-103	1,500.00	1,750.00	— 250.00
X-107	1,200.00	1,200.00	–
	$3,200.00	$3,500 00	—$300.00

* — = unfavorable.

It has been assumed above that the direct material price variance is determined when the materials are purchased. When this is done the price variance is usually computed in connection with the process of checking extensions on the supplier's invoices by multiplying quantities by both actual and standard prices. Some companies do not determine direct material price variance until the materials are used. In such cases the actual quantity of material *used* rather than the quantity *purchased* is employed for calculating the variance.[1]

Where the Stores account is debited at standard, the price variance is separated from actual cost when materials are charged to Stores. An objection to keeping raw materials inventories at standard cost is that price variances may not appear in the same period in which the materials are actually put into production. If the plant follows the practice of charging variances to Profit and Loss at the time when purchases are made, there may be marked fluctuations in net profit that have no connection with production and sales. This effect upon the profit and loss statement can, however, be avoided by setting up price variances as deferred items to be written off as materials are put into process or as goods are sold. The journal entries and ledger accounts in Figure 102 show the different methods for handling the Stores account. The first two produce, of course, different results. The third is a compromise between the other two. Under the third method, a price variance suspense account is created at the time the invoice is recorded. When stores are issued the suspense account is adjusted. Any balance in the suspense account is treated as a valuation item, being added to, or deducted from, the standard stores value. Thus the same price variance is obtained as under the first method. On the balance sheet, the compromise method works out as follows:

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[1] In a group of 72 companies examined, approximately three-fourths of these companies priced materials at standard price when the materials were received. *Standard Costs for Costing Inventories,* N.A.C.A. Research Series No. 13, p. 1247.

Stores (standard)	$2,000.00	
Material Price Suspense	1,000.00	$3,000 00

The net effect is the same as when the price variance is recorded at the time of issue.

Direct Material Usage Variance. A direct material usage variance arises when the actual quantity of direct material used differs from the standard quantity for the amount of production turned out. The variance can thus be computed in terms of physical quantities, i.e., as pounds, pieces, or other units. However, it is ordinarily expressed in dollars by pricing both standard and actual quantities at the standard unit price. By using the standard price for both quantities it is possible to measure the difference in cost due to quantity of material used as well as the difference in cost due to material price.

Material usage variances are due to such causes as (1) waste and loss of materials in handling or processing, (2) spoilage or production of excessive scrap, (3) variation in yields from materials, (4) substitution of nonstandard materials, and (5) changes in product specifications which have not been incorporated in standards. The over-all material usage variance can be analyzed by causes such as these if desired. Where control of some of these sources of material loss is especially important, steps may be taken to detect the losses as near to the source as practicable. Among measures for such a purpose are:

1. Inspection of work at suitable points. Reports of rejected material serve to inform management and to provide the basis for determining the amount of the variance.
2. Measurement of scrap and spoiled material to determine the variance in material cost due to these factors.
3. Comparison of actual yield with standard yield for each run of material to determine material loss from low yields.

I. Price Variance at Time of Purchase

(1)

Stores	$3,000	
Material Price Variance	1,500	
Accounts Payable		$4,500

To record purchase of 3,000 units in Stores account at standard cost of $1 00 each.

(2)

Work in Process	$1,000	
Stores		$1,000

To record issuance of 1,000 units at $1.00 standard cost.

STORES

(1) Std.	$3,000	(2) Std.	$1,000
		Bal. (Std)	2,000
	$3,000		$3,000

WORK IN PROCESS

(2) Std.	$1,000		

MATERIAL PRICE VARIANCE

(1)	$1,500		

II. Price Variance at Time of Issue

(1)

Stores	$4,500	
Accounts Payable		$4,500

To record purchases of 3,000 units at $1.50 actual cost.

(2)

Work in Process	$1.000	
Material Price Variance	500	
Stores		$1,500

To record issuance of 1.000 units at $1.00 standard cost.

STORES

(1) Act.	$4.500	(2) Act.	$1,500
		Bal. (Act)	3,000
	$4.500		$4.500

WORK IN PROCESS

(2) Std	$1,000		

MATERIAL PRICE VARIANCE

(2)	$ 500		

III. Price Variance at Purchase and Issue

(1)

Stores	$3,000	
Material Price Suspense	1,500	
Accounts Payable		$4,500

To record purchase of 3,000 units in Stores account at standard cost, charging price variance to a suspense account.

(2)

Work in Process	$1,000	
Stores		$1,000

To record issuance of 1,000 units at $1 00 standard cost.

(3)

Material Price Variance	$ 500	
Material Price Suspense		$ 500

To relieve suspense account of the price variance at $.50 each on 1,000 units issued.

STORES

(1) Std.	$3.000	(2) Std.	$1.000
		Bal. (Std.)	2.000
	$3.000		$3.000

WORK IN PROCESS

(2) Std.	$1.000		

MATERIAL PRICE SUSPENSE

(1)	$1,500	(3)	$ 500
		Bal.	1,000
	$1.500		$1,500

MATERIAL PRICE VARIANCE

(3)	$ 500		

FIGURE 102. Methods for Handling Material Price Variances

Computation of direct material usage variance is illustrated below:

Material	Standard Unit Price	Standard Quantity to Be Used	Actual Quantity Used	Standard Quantity at Standard Price	Actual Quantity at Standard Price	Usage Variance*
A	$1.00	5,000 units	5,200 units	$ 5,000 00	$ 5,200.00	—$200 00
B	1.50	2,000 "	1,900 "	3,000.00	2,850.00	+ 150.00
C	2.00	3,000 "	3,150 "	6,000.00	6,300.00	— 300.00
				$14,000 00	$14,350 00	—$350 00

* — = unfavorable; + = favorable

Determination of the actual and standard quantities of materials is made in various ways. A common method used in practice is to prepare a requisition for the quantity specified in the bill of materials. If additional materials are needed to complete the order, another requisition must be prepared. The quantities on these *excess quantity requisitions* extended at standard prices are summarized to give the material usage variance. The requisitions also call attention to the fact that the standard is not being met, for they must be approved by the departmental supervisor before the materials are issued.

Another method, used in a plant making metal stampings, is to mark on each requisition the standard number of pieces to be produced from the steel sheets issued. Actual production on each order is reported. Failure of actual production is due to spoilage of pieces. By summarizing the number of spoiled pieces and multiplying by the standard material price, the material quantity variance is obtained.

Direct Labor Variances. Direct labor variance is composed of the difference between standard direct labor cost of production and the actual direct labor costs. Variances in direct labor costs arise (1) when rates paid for labor differ from standard rates and (2) when the time taken to complete a given task differs from the standard time. The first is the direct labor rate variance and the second is the direct labor efficiency variance. They are analogous to the direct material price and usage variances.

Expressing the definitions of these two variances as formulas, they are:

Direct labor rate variance = Actual hours used × (Standard rate — Actual hourly rate)

Labor efficiency variance = Standard labor rate × (Standard hours — Actual labor hours)

Computation of Direct Labor Cost Variances. In order to compute the labor cost variances, the following data are necessary:

1. Standard hourly wage rate
2. Standard time per unit of product
3. Actual hourly wage rate paid
4. Number of hours actually worked
5. Number of product units in attained production

The first two items listed above are obtained from the standard cost records while the remaining items are taken from current payroll and production records.

Illustration of Labor Variance Calculation. The standard cost card for Product A gives the following information:

DIRECT LABOR

Operation Number	Standard Hours	Standard Rate per Hour	Totals
1	5	$1.50	$ 7.50
2	15	1.60	24.00
3	3	1.75	5.25
4	7	1.95	13.65
Total hours	30	Total cost	$50.40

Production records show that during the month 100 units of Product A were put into production and carried through Operations 1 and 2. However, only 80 units had progressed through Operations 3 and 4 at the close of the period, leaving a work in process inventory of 20 units at the end of Operation 2. Production and payroll records show the following:

Operation Number	Units Completed	Actual Hours Worked	Actual Rate Paid	Actual Payroll
1	100	525	$1.50	$ 787.50
2	100	1,540	1.65	2,541.00
3	80	230	1.80	414.00
4	80	560	1.90	1,064.00
				$4,806.50

Computation of the labor rate variance (by operations):

Operation 1: 525 × ($1.50 − $1.50) = $ 0.00
2: 1,540 × ($1.60 − $1.65) = − 77.00
3: 230 × ($1.75 − $1.80) = − 11.50
4: 560 × ($1.95 − $1.90) = + 28.00
Total . . — $60.50

Computation of the labor efficiency variance requires calculation of standard cost of completed production as follows, using data previously given:

Operation	Units Completed	Standard Cost per Unit	Standard Cost of Completed Production
1	100	$ 7.50	$ 750.00
2	100	24.00	2,400.00
3	80	5.25	420.00
4	80	13.65	1,092.00
			$4,662.00

It should be noted that where unfinished units are still in process, the standard cost of the standard hours of labor in the product at the stage of completion reached must be used.

Next, the actual hours worked must be extended at the standard rates per hour:

Operation	Actual Hours	Standard Hourly Rate	Standard Cost of Actual Hours
1	525	$1.50	$ 787.50
2	. 1,540	1.60	2,464.00
3	230	1.75	402 50
4	560	1.95	1,092.00
			$4,746.00

Labor efficiency variances by operations then are:

Operation	Standard Cost of Completed Production	Standard Cost of Actual Hours	Efficiency Variance
1	$ 750.00	$ 787.50	– $37.50
2	2,400.00	2,464 00	– 64 00
3	420 00	402 50	+ 17.50
4	1,092.00	1,092 00	0 00
	$4,662.00	$4,746.00	– $84 00

The sum of the above variances should equal the difference between standard cost of completed production and actual cost of actual hours worked: Thus:

Standard cost of completed production	$4,662.00
Actual cost of actual hours worked	4,806.50
Total variance	– $ 144.50
Rate variance	– $ 60.50
Efficiency variance	– 84.00
	– $ 144.50

Analysis of Direct Labor Rate Variances by Causes. Labor rate variances may result from (1) change in labor rates which have not been incorporated in standards, (2) inclusion of more lower or higher paid employees in the group when the standard rate is an average, and (3) use of an employee having a wage classification other than that contemplated when the standard for a job was set. The effect of a change in wage rate paid is obvious. An illustration of the second cause of rate variances appears below. A department employed 15 men at rates from $1.15 to $1.35 per hour as follows:

Number of Employees	Rate per Hour	Amount
3	$1.15	$ 3.45
7	1.25	8.75
5	1.35	6.75
15		$18.95
Average rate per hour (standard)		$ 1.26⅓

The average actual rate paid, however, deviated from the above because one of the men in the $1.25 class became eligible for the maximum rate and two men in the $1.25 class resigned and were replaced with new employees at the minimum rate. Hence the result was:

Number of Employees	Rate per Hour	Amount
5	$1.15	$ 5.75
4	1.25	5.00
6	1.35	8.10
15		$18.85
Average rate per hour (actual)		$ 1.25⅔

If the above department operates for 40 hours in a given week, the actual wages paid are $754 (i.e., 600 hours at $1.25⅔) and the standard amount is $758 (600 hours at $1.26⅓), thus leaving a rate variance of $4.00.

Rate variances may result from the use of employees in a classification carrying a nonstandard rate, such as placing skilled employees at unskilled tasks during a period of temporarily low activity or use of men in jobs for which women are ordinarily employed.

Reporting Labor Variances. Unfavorable labor variances are often an important source of loss. For this reason many companies report variances to foremen weekly or even daily. In order to provide reports at frequent intervals and to have the reports in the hands of foremen promptly, labor variances are usually determined by summarizing the time tickets or periodic time reports. For example, timekeepers may enter both standard and actual time on job time tickets. The variance is then readily tabulated by summarizing the time tickets. Causes of variances are also entered on the time tickets, usually by means of code numbers for which the following is an example:[2]

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[2] "Standards to Aid Control of Manufacturing Costs," Research Series No. 12, *N.A.C.A. Bulletin*, March 15, 1948, p. 920.

114 – Nonpreferred equipment or rerouted work
115 – Breakdown
116 – Idle equipment
117 – Other piecework allowances
119 – Hard castings

Manufacturing Overhead Variances

Components of Overhead Cost Variance. The difference between the amount of manufacturing overhead actually incurred and the amount applied to production constitutes the total overhead variance. This difference may be analyzed in terms of two principal causes:

1. Spending more or less than allowed by the flexible budget for the actual hours operated. This is termed the *controllable variance.* It is measured by the difference between the flexible budget allowance for the standard hours in the product and the actual overhead expense for the period.
2. Under- or overabsorption of overhead cost resulting from production at a rate above or below the normal or standard volume for the period. This is the *utilization or volume variance.* It is computed by taking the difference between the flexible budget allowance and the amount of overhead absorbed in production at the standard overhead rate.

Causes of Overhead Variances. The causes of overhead variances are to some extent the same as the causes producing material and labor variances, since they are bound to react on each other. A change in material specifications may cause excessive spoilage resulting in an expense variance. Poorly trained help or frequent changes in design may likewise cause corresponding wastes in manufacturing overhead. Nevertheless, it is possible to classify the sources of overhead variances somewhat as follows:

1. Using wrong grade of materials
2. Using wrong grade of labor
3. Failure to get most favorable terms in buying supplies and services
4. Changes in market price
5. Efficiency
    - *a*) Waste of materials
    - *b*) Inefficient labor performance
    - *c*) Failure to curtail usage of materials and services to correspond with output level
    - *d*) Employees waiting for work
    - *e*) Avoidable machine breakdowns

   - *f*) Lack of operators
   - *g*) Lack of tools
   - *h*) Lack of instructions

6. Volume
   - *a*) Decrease in customer demand
   - *b*) Calendar fluctuations
   - *c*) Excess plant capacity

Responsibility for Overhead Variances. Control of manufacturing overhead starts with properly set standards. The responsibility for keeping cost within standard limits is assigned to the person in the organization who has authority to control spending. The responsibility for efficiency variances is not difficult to place, but volume variances raise a need for analysis of each specific case to place personal responsibility. Thus, for example, a given volume variance loss may be a combination resulting from a foreman's delay in providing instructions to an operator, the production control department's failure to maintain an even flow of work, and the sales department's inability to procure enough orders to keep the factory occupied. The important thing here is for the management to ascertain what causes the idle time and who has the authority and responsibility to control it.

Even that part of the volume variance which arises from so-called noncontrollable causes must be analyzed and responsibility placed, for such items may be controllable in the long run by major executives who possess authority to determine what the size of the plant and organization shall be.

The volume variance is the principal indicator of how well long-range plans concerning productive capacity turn out, because on the one hand this variance measures the degree of absorption of fixed charges and, on the other, long-lived assets are largely responsible for these fixed charges. Hence volume variances deserve careful analysis to determine personal responsibility and to find remedies for unfavorable conditions. During short periods some definite remedial action can usually be taken regarding efficiency variances, while the volume variance can at least be substantially reduced. From a long-run point of view all expenses are controllable, although it may be good business policy to incur a certain amount of idle time because the provision of facilities for future growth is often accomplished most cheaply in advance of need, during the period of the business cycle favoring acquisition of the needed equipment.

Computation of Manufacturing Overhead Variances (Two-Variance System). In order to illustrate the computation of manufacturing overhead variances, the following data are assumed for Cost Center A:

1. Flexible overhead standards:

	Fixed	Variable	
Supervision	$125.00 +	$ .185	per standard hour
Indirect labor	75 00 +	.125	" " "
Maintenance	50.00 +	.10	" " "
Supplies	25.00 +	.06	" " "
Power	200.00 +	.13	" " "
Depreciation	75.00	—	
Taxes	25.00	—	
Insurance	25.00	—	
Total	$600.00 +	$ .60	per standard hour

2. Standard hours per month		1,500
3. Standard overhead rate		
a) Fixed component	$ .40	per standard hour
b) Variable component	.60	" " "
Total	$1 00	" " "
4. Actual hours worked during month		1,200
5. Actual overhead cost		$1,380 00
6. Standard hours in product for the month		1,000

At the end of the month of July, a statement of manufacturing overhead for Cost Center A is prepared as shown in Figure 103. It shows a comparison of budgeted and actual expenses at the attained production volume.

The budget figures in the illustration are arrived at by applying the flexible overhead standards. Thus supervision ($310) is composed of a fixed element of $125 plus the variable cost of $.185 times 1,000 standard hours. In this way the total budget of $1,200 for the *standard* hours produced is arrived at.

In addition to the budgeted and actual overhead, Figure 103 shows the overhead charged to Work in Process through the application of the standard overhead rate. The difference between the latter figure and the actual expense is the total variance. It is this figure which is subjected to further analysis in order to discover the basic causes underlying the variance.

The capacity or volume variance is computed by the following formula:

(Standard hours in product × Standard overhead rate) — Budget allowed for standard hours produced

Applied to the above figures the volume variance is $1,000 — $1,200, or —$200. Capacity of the department is 1,500 hours per month, but production of only 1,000 hours was attained in July. In other words, the department operated at only two thirds of capacity and suffered idle capacity amounting to one third. Since fixed charges can be fully absorbed only if the department operates at standard capacity, it is evident that there must be an underabsorption of fixed charges. This is the measure of capacity variance and in this case amounts to one third of the fixed charges in the budget, or $200.

COST CENTER A

COMPARISON OF ACTUAL AND BUDGETED OVERHEAD

MONTH OF JULY, 19—

Actual Hours Worked .. 1,200 Standard Hours Produced 1,000
Standard Activity 1,500 hrs. Standard Overhead Rate . . . $1/hr.

	Budget for 1,000 hrs.	Actual 1,200 hrs.	Controllable Variance
Controllable Overhead:			
Supervision	$ 310.00	$ 310.00	$ –
Indirect Labor	200.00	240.00	(40.00)
Maintenance	150.00	220.00	(70.00)
Supplies	85.00	60.00	25.00
Power	330.00	425.00	(95.00)
	$1,075.00	$1,255.00	$(180.00)
Noncontrollable Overhead:			
Depreciation	75.00	75.00	–
Taxes	25.00	25.00	–
Insurance	25.00	25.00	–
	$1,200.00	$1,380.00	$(180.00)
Overhead charged to product: 1,000 hrs. at $1		1,000.00	
Total overhead variance		$ 380.00	

FIGURE 103. Monthly Overhead Statement

The controllable variance is obtained from the following formula:

Budget allowed for standard hours produced — Actual expense

Using the above figures the controllable variance is $1,200 — $1,380, or —$180. In this case actual expenses have exceeded budgeted expenses and hence the variance is unfavorable. In Figure 103 the controllable variance is shown in detail by items of expense in order that the supervisor in charge of the department may know which individual expenses were out of line, since responsibility for control of the controllable variance rests with the department head.

Computation of Manufacturing Overhead Variances (Three-Variance System). Some cost accountants feel that the two-variance method is inadequate. They therefore propose a variety of overhead analyses showing three variances. Of the various methods put forth the following seems logical and is in fairly common use:

1. Volume variance = (Standard hours in product × Standard rate) — Budget allowed for *standard* hours
2. Efficiency variance = Budget allowed for standard hours — Budget allowed for *actual* hours
3. Budget or spending variance = Budget allowed for actual hours — Actual manufacturing overhead

Applied to the above figures, the following results are obtained:

1. Volume variance = $1,000 – $1,200 = – $200.00
2. Efficiency variance = 1,200 – 1,320 = – 120.00
3. Spending variance = 1,320 – 1,380 = – 60.00

Total variance accounted for – $380.00

It may be seen at once that there is no difference in the volume variance between the two systems. What happens is that under the three-variance system the controllable variance is further analyzed into an efficiency and a budget or spending variance. The former results from a comparison of the allowed budgets for the actual and the standard hours. The remaining variance represents a variety of factors. It may represent a price factor in the sense that higher or lower prices were paid for supplies and services than were allowed for in the budget. However, it may also mean that a greater or lesser quantum of supplies and services was used than the budget provided.[3]

Short Cut Methods for Computing Overhead Variances. The computation of variances is a fairly simple process. In fact it can be reduced to a mechanical routine. The previous pages have set forth the rationale of variance analysis. The presentation which follows shows the mechanics of such analysis in practice applied to material, labor, and overhead variances.

As to material, three figures are necessary. They are:

1. The standard cost of the standard allowed quantity in the product
2. The standard cost of the actual quantity used
3. The actual cost of the actual quantity

Each of these figures is made up of two elements, quantity and unit cost, and each element may be represented either at standard or actual. The information may be arranged in tabular form as shown in Figure 104. It is based on the following data:

1. From the standard cost sheet	
a) Standard quantity per unit of product	.5 lb.
b) Standard cost per pound	$1.20
2. Production report	2,000 units
3. Stores requisitions	1,100 lbs.
4. Invoices or other sources, actual cost per pound	$1.15

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[3] For a more extended discussion of analysis of manufacturing overhead variances, see Theodore Lang (ed.), *Cost Accountants' Handbook* (New York: The Ronald Press Co., 1944), Section 2.

Column 1 in Figure 104 represents the proper charge to work in process. The allowed quantity for 2,000 units produced is 1,000 pounds (i.e., 2,000 × .5 pounds). Priced at the standard cost per pound of $1.20, this yields $1,200 in the first column. The requisitions show that 1,100 pounds were actually withdrawn from stock. These are priced at standard and the total is shown in Column 2. Finally the actual costs are shown in Column 3. The variances are then obtained by successive subtractions. The total variance in Column 4 represents the difference between the first and third columns. Since the *same unit price* was used in Columns 1 and 2, any difference in the totals must result from different quantities. Hence, the difference is a quantity or usage variance and is shown in Column 5. Finally it is to be noted that the *same quantity* was used in Columns 2 and 3; hence, any difference must be due to differences between actual and standard rates (Column 6).

In the above illustration it was assumed that the variances are obtained by analysis. As pointed out earlier, the price variance may be obtained automatically at time of vouchering the invoice, and the usage requisition by employing excess material requisitions.

Direct labor variances may be obtained by a process similar to the analysis of material variances. They are shown in Figure 105 and are based on the following data:

1. From standard cost sheet	
a) Standard time allowed for operation	.04 hr.
b) Standard rate per hour	$1.60
2. Production report	2,000 units
3. Time tickets	90 hrs.
4. Payroll (actual rate paid $1.70)	$153.00

(1)	(2)	(3)	(4)	(5)	(6)
Standard Quantity in Product at Standard Rate	Actual Quantity at Standard Rate	Actual Quantity at Actual Rate		Variances	
			Total (1) − (3)	Usage (1) − (2)	Price (2) − (3)
1,000 × $1.20 $1,200.00	1,100 × $1.20 $1,320	1,100 × $1.15 $1,265	− $65.00	− $120.00	+ $55.00

FIGURE 104. Material Cost Variances

(1)	(2)	(3)	(4)	(5)	(6)
Standard Allowed Time in Product at Standard Rate	Actual Time at Standard Rate	Actual Time at Actual Rate		Variances	
			Total (1) − (3)	Time (1) − (2)	Rate (2) − (3)
2,000 × .04 × $1.60 $128.00	90 × $1.60 $144.00	90 × $1.70 $153.00	− $25.00	− $16.00	− $9.00

FIGURE 105. Direct Labor Cost Variances

(1)	(2)		(3)	(4)	(5)	(6)
Standard Hours in Product at Standard Rate	Allowed Budget for Standard Hours in Product		Actual Overhead		Variances	
				Total (1) − (3)	Capacity (1) − (2)	Controllable (2) − (3)
1,000 × $1.00	Fixed	$ 600.00				
	Variable .	600.00				
$1,000.00		$1,200.00	$1,380.00	− $380.00	− $200.00	− $180.00

FIGURE 106. Analysis of Overhead Variances (Two Variances)

(1)	(2)		(3)		(4)	(5)	(6)	(7)	(8)
Standard Hours in Product at Standard Rate	Allowed Budget for Standard Hours in Product		Allowed Budget for Actual Hours Worked		Actual Overhead		Variances		
						Total (1) − (4)	Volume (1) − (2)	Efficiency (2) − (3)	Budget (3) − (4)
1,000 × $1.00	Fixed	$ 600.00	Fixed	$ 600.00					
	Variable	600.00	Variable .	720.00					
$1,000.00		$1,200.00		$1,320.00	$1,380.00	− $380.00	− $200.00	− $120.00	− $60.00

FIGURE 107. Analysis of Overhead Variances (Three Variances)

The analysis of manufacturing overhead may be accomplished by a process similar to that for direct material and direct labor though it may be a bit more complex. In Figures 106 and 107 the same basic data are used as in Figure 103. As may readily be seen, the process of variance determination becomes automatic.

QUESTIONS

1. Is variance analysis itself a cure for unfavorable results?
2. Discuss three types of variance reports prepared during the month which are independent of monthly summary entries.
3. How do material quantity standards aid in cost control?
4. Unfavorable material variances determined at the end of a period are frequently discovered too late to stop specific losses. What methods would you suggest for determining usage variances nearer to their source?
5. Some companies insist on furnishing regular material variance reports to machine operators, foremen, departmental supervisors, the factory superintendent, and the vice president in charge of production. Discuss the advantages of such a policy.
6. What procedure would you recommend to assure that action is taken where significant material usage variances appear?
7. Indicate three reasons for material price variances other than inability of the manufacturing department to acquire the goods at standard prices.
8. It is maintained by some accountants that the responsibility of the purchasing department in connection with price variances is basically one of error in forecasting what material prices should be rather than their inability to buy at standard price. Explain.
9. Explain how a bonus system might be used in conjunction with control of manufacturing overhead through standards.
10. A recent survey showed that relatively few companies developed labor rate variance analyses.
    a) Why should this be so?
    b) List three causes for labor rate variances.
11. Explain the relationship of incentive wage plans and control of labor under a system of standards.
12. Are volume variances entirely due to external factors? Explain.
13. How is responsibility placed for controllable overhead variance?

Chapter 19

OPERATION OF STANDARD COSTS—CURRENT STANDARDS

Incorporating Standard Costs in the Accounts. Standard costs are generally incorporated into the cost accounts, although some concerns prefer to use them purely for statistical comparisons. Standard cost systems are of two fundamental types, all others being modifications in one or more particulars of these two:

1. Current standards
2. Measurement standards (covered in the next chapter)

Characteristics of Current Standards. Various names have been given to the two types mentioned above, each one intended to stress one or another characteristic. By the term "current standards" is meant a type of standard costing in which the standards are revised annually or more often. Needless to say, all standard cost systems must revise standards to conform to changes in material specifications or in technology. Annual revisions are intended to incorporate anticipated *price changes* in the standards. In this way the standards represent *current* price levels, hence the name.

It is apparent that two possible disadvantages result from the use of current standards. The first has reference to the time and expense involved in periodic revisions of the standards. Since the period of World War II this limitation has become doubly apparent. Constant price changes as well as technological changes have been the order of the day and have imposed a heavy burden on the cost accountant to keep his standards truly current. The second limitation is due to the fact that by changing standards, the comparability of figures for different periods is destroyed. To this the cost accountant may answer that for cost purposes he is primarily interested in comparing actual and standard costs *for the same period.*

A second characteristic of current standards concerns the manner of keeping the cost controlling accounts. Although it is possible to keep the Stores account at actual cost, it may be stated as a general rule that all inventory accounts as well as Cost of Sales are debited and credited at *standard* cost. In turn this means that, unless variances from standard are prorated back to inventories, the latter appear in the balance sheet at *standard* cost. Public accountants, however, generally feel that actual costs should be shown in statements, subject only to the general rule of inventory valuation at the lower of cost or replacement value. Against this it may be urged that even so-called actual costs are in large part estimates (e.g., depreciation and bad debts), particularly where inventory values have been made to depend on the results of prorations. Finally, every cost accountant knows that "actual" inventory costs frequently include the cost of every kind of inefficiency and waste of materials, and manpower. In short, a current standard cost, because it represents what an item should cost under carefully controlled conditions, is in reality the true cost and is quite likely to be more conservative than the actual cost.

The final feature of current standards refers to the manner in which variances are shown. All standard cost systems seek to establish variations from standard and their causes. In the case of current standards variances are obtained as an integral part of the double-entry process. Accounts for each kind of variance appear in the ledger and in the trial balance.

Illustration of Current Standard Cost System. The example on the succeeding pages illustrates the operation of the manufacturing accounts by following, step by step, the flow of costs from the initial purchase of materials and services to the final summary of results in the financial statements. The company is assumed to be one which has two productive departments (Department A and Department B) and one service department, which is a power plant. The product goes through four operations, the first two of which are carried out in Department A, while Operations 3 and 4 are carried out in Department B. Three kinds of material (designated as M-1, M-2, and M-3) are used, the first two being issued at the beginning of Operation 1 and the third at the time work enters Operation 3.

Entries and statements are based upon the standard cost sheet (Figure 108), flexible budget (Figure 109), and the statement of transactions on pages 384 and 385. Unless otherwise stated, transactions are recorded through the factory journal. Entries other than closing entries are numbered to correspond to paragraph numbering under the statement of transactions.

These transactions are then recorded and followed through on the basis of current standards. The next chapter will illustrate the handling of the same transactions on the basis of measurement standards.

STATEMENT OF PROBLEM

Opening Inventory Balances:

	Actual	Standard
a) Raw Material		
M-1 150 material units	$ 350.00	$ 300.00
M-2 50 " "	400.00	500.00
M-3 600 " "	2,250.00	2,400.00
Total Raw Material	$3,000.00	$3,200.00
b) Supplies (at actual cost) for which a separate account is kept in factory ledger	$1,000.00	–
c) Work in process		
Department A—20 product units, all material issued, no labor or overhead.	$ 625.00	$ 600.00
Department B—5 product units, all material issued, no labor or overhead in Department B.	750.00	772.50
Total Work in Process	$1,375 00	$1,372.50
d) Finished Goods		
10 units	$2,100.00	$2,223.50
Total costs	$7,475.00	$6,796.00

All variances at the end of the prior period have been closed out to the general ledger.

Materials					
Kind	Quantity	Standard Unit Cost		Totals	
M-1	5 units	$ 2.00		$10.00	
M-2	2 units	10.00		20.00	
M-3	12 units	4.00		48.00	
Total Material Cost					$ 78.00
Direct Labor					
Operation Number	Standard Hours	Standard Rate per Hour			
1	5	$ 1.50		$ 7.50	
2	15	1.60		24.00	
3	3	1.75		5.25	
4	7	1.80		12.60	
Total Hours	30				
Total Labor Cost					49.35
Overhead	Rate per Direct Labor Hour	Standard Hours			
Department A					
Operation 1	$2.25	5	$11.25		
Operation 2	2.25	15	33.75	$45.00	
Department B					
Operation 3	$5.00	3	$15.00		
Operation 4	5.00	7	35.00	50.00	
Total Overhead Cost					95.00
Standard Unit Cost					$222.35

FIGURE 108. Standard Cost Sheet

	OVERHEAD DISTRIBUTION AT STANDARD CAPACITY (100%)				FLEXIBLE BUDGET FORMULAS					
					Department A		Department B		Power	
	Total	A	B	Power	Fixed Amount	Variable Amount per Man-Hour	Fixed Amount	Variable Amount per Man-Hour	Fixed Amount	Variable Amount per Kwh
Supervision .	$1,800.00	$ 900.00	$ 500.00	$ 400.00	$ 300.00	$ .30	$ 175.00	$ .325	$ 400.00	–
Indirect Labor	3,100.00	1,880.00	620.00	600.00	400.00	.74	100.00	.52	100.00	.005
Fuel . . .	600.00	–	–	600.00	–	–	–	–	100.00	.005
Water	200.00	–	–	200.00	–	–	–	–	50.00	.0015
Supplies	650.00	250.00	300.00	100.00	80.00	.085	125.00	.175	50.00	.0005
Maintenance	1,000.00	300.00	400.00	300.00	120.00	.09	200.00	.20	100.00	.002
Depreciation . . .	1,300.00	200.00	1,000.00	100.00	200.00	–	1,000.00	–	100.00	–
Taxes and Insurance .	850.00	250.00	500.00	100.00	250.00	–	500.00	–	100.00	–
Power and Heat .		720.00	1,680.00	$2,400.00	300.00	.21	700.00	.98	–	–
A, 30,000 kwh										
B, 70,000 kwh										
	$9,500.00	$4,500.00	$5,000.00		$1,650.00	$1.425	$2,800.00	$2.20	$1,000.00	$ .014
Number of direct labor hours		2,000	1,000							
Number of kwh . . .				100,000						
Normal overhead rate per direct labor hour:										
Fixed rate		$ .825	$ 2.80							
Variable rate . . .		1.425	2.20							
Total overhead rate . .		$ 2.25	$ 5.00							

FIGURE 109. Departmental Overhead and Flexible Budget Standards

Statement of Transactions. The following transactions are assumed to have occurred during the month:

1. *a*) Record the opening inventory balances through a formal journal entry.

   b) Purchases of materials:

Kind	Units	Actual Unit Price	Actual Cost	Standard Cost
M-1	1,000	$ 1.80	$ 1,800.00	$ 2,000.00
M-2	500	10.50	5,250.00	5,000.00
M-3	5,000	4.25	21,250.00	20,000.00
			$28,300.00	$27,000.00

2. Materials put into process—standard quantities:

Kind	Units	
M-1	550	(for 110 product units)
M-2	220	(for 110 product units)
M-3	1,260	(for 105 product units)

3. Excess materials issued:

Kind	Units
M-1	20
M-2	5

4. Payroll data: Total payroll $9,635.
5. Direct labor used:

Operation	Actual Hours	Actual Rate	Actual Payroll	
1	570	$1 50	$ 855.00	(for 105 product units)
2	1,540	1.55	2,387.00	(for 105 product units)
3	230	1.80	414.00	(for 80 product units)
4	660	1.90	1,254.00	(for 80 product units)
			$4,910 00	

Indirect labor, including supervision, is recorded in transaction 7.

6. Overhead costs are applied to the product on basis of standard man-hours in the product.

7. Actual overhead costs incurred: See Figure 110.

8. Work completed during month in Department A: 105 units completed and transferred to Department B.

9. Work completed during month in Department B: 80 units completed and transferred to finished goods.

Closing inventory of work in process:

Department A: 25 units, all material issued, no labor or overhead incurred

Department B: 30 units, all material issued, no labor or overhead incurred

10. Sales: 70 units at $350 each.
11. Operating Expenses: $3,000.

ACTUAL DEPARTMENTAL OVERHEAD

	Total	Department A 105% [1]	Department B 80% [1]	Power 97,000 Kwh
Supervision	$1,875.00	$1,000.00	$ 475.00	$ 400.00
Indirect Labor	2,850.00	1,800.00	450.00	600.00
Fuel	550.00	–	–	550.00
Water	200.00	–	–	200.00
Supplies	610.00	230.00	280.00	100.00
Maintenance	950.00	325.00	350.00	275.00
Depreciation	1,300.00	200.00	1,000.00	100.00
Taxes and Insurance	850.00	250.00	500.00	100.00
Total Direct Charges	$9,185.00	$3,805.00	$3,055.00	$2,325.00
Distribution of Power Charge:				
Department A: (34,000 kwh × $.014) + $300.00		776.00		
Department B: (63,000 kwh × $.014) + $700.00			1,582.00	(2,358.00) [2]
Total Charges	$9,185.00	$4,581.00	$4,637.00	$ 33.00 [2]

[1] Indicates percentage of capacity operated.

[2] Red; the balance of $33 in the Power account represents a favorable variance.

FIGURE 110. Actual Manufacturing Overhead

JOURNAL ENTRIES

(Current Standards)

(1a)

Stores	$ 3,200.00	
Supplies Inventory	1,000.00	
Work in Process—Department A	600.00	
Work in Process—Department B	772.50	
Finished Goods	2,223.50	
General Ledger (Proprietorship)		$ 7,796.00

To record opening inventories at standard cost including the supplies inventory at *actual* cost.

(1b)

Stores	$27,000.00	
Material Price Variance	1,300.00	
General Ledger		$28,300.00

To charge raw material account with standard cost of materials purchased and establish purchase price variance.

(2)

Work in Process—Department A (110 × $30)	$ 3,300.00	
Work in Process—Department B (105 × $48)	5,040.00	
Stores		$ 8,340.00

To charge product for standard quantity of materials called for on production schedules at standard cost:

M-1: 110 × 5 × $ 2	$1,100.00	
M-2: 110 × 2 × $10	2,200.00	$ 3,300.00
M-3: 105 × 12 × $ 4		5,040.00
		$ 8,340.00

(3)

Material Usage Variance	$ 90.00	
Stores		$ 90.00

To charge excess material issued to variance at standard cost:

M-1: 20 × $ 2	$ 40.00	
M-2: 5 × $10	50.00	$ 90.00

(4)

Factory Payroll	$ 9,635.00	
General Ledger		$ 9,635.00

To record actual payroll.

(5a)

Work in Process—Department A	$ 3,307.50	
Work in Process—Department B	1,428.00	
Total Direct Labor Variance	174.50	
Factory Payroll		$ 4,910.00

To charge product with direct labor at standard and set up total variance (Figure 111).

(5b)

Direct Labor Time Variance	$ 174.00	
Direct Labor Rate Variance	.50	
Total Direct Labor Variance		$ 174.50

To analyze total variance into its components (Figure 111).

(6)

Work in Process—Department A	$ 4,725.00	
Work in Process—Department B	4,000.00	
Applied Manufacturing Overhead		$ 8,725.00

To charge production at standard rate (Figure 112).

(7)

Manufacturing Overhead—Actual	$ 9,185.00	
Factory Payroll		$ 4,725.00
Supplies Inventory		610 00
General Ledger		3,850.00

To record actual direct departmental expenses incurred including supervision, other indirect labor, and supplies consumed (see Figure 110).

(8)

Work in Process—Department B	$11,182.50	
Work in Process—Department A		$11,182.50

To record transfer of 105 product units at standard cost (from standard cost card, Figure 108):

Material M-1	$10.00	
M-2	20.00	$ 30.00
Labor Operation 1	$ 7.50	
Labor Operation 2	24.00	31.50
Overhead Operation 1	$11.25	
Overhead Operation 2	33.75	45.00
Total		$ 106.50
Number of units		105
Total cost		$11,182.50

(9)

Finished Goods	$17,788.00	
Work in Process—Department B		$17,788.00

To record transfer of 80 product units to finished stock at standard cost:

80 × $222.35 = $17,788.00

(10)

Cost of Sales	$15,564.50	
Finished Goods		$15,564.50

To record standard cost of 70 units sold:

70 × $222.35 = $15,564.50

(11)

Applied Manufacturing Overhead	$ 8,725.00	
Total Manufacturing Overhead Variance	493.00	
Manufacturing Overhead—Actual		$ 9,218.00

To close and establish total underapplied expense. See Figure 110.

(12)

Manufacturing Overhead Capacity Variance	$ 477.50	
Manufacturing Overhead Efficiency Variance	212.25	
Manufacturing Overhead Budget Variance		$ 196.75
Total Manufacturing Overhead Variance		493.00

To analyze manufacturing overhead variances (see Figure 112).

Department	Operation	Standard Hours Produced	Standard Hourly Rate	Actual Hours	Actual Hourly Rate	Standard Hours × Standard Rate *	Actual Hours × Standard Rate	Actual Hours × Actual Rate	Variances		
									Total	Time	Rate
A	1	525	$1.50	570	$1.50	$ 787.50	$ 855.00	$ 855.00	−$ 67.50	−$ 67.50	$ 0
	2	1,575	1.60	1,540	1.55	2,520.00	2,464.00	2,387.00	+ 133.00	+ 56.00	+ 77.00
B	3	240	1.75	230	1.80	420.00	402.50	414.00	+ 6.00	+ 17.50	− 11.50
	4	560	1.80	660	1.90	1,008.00	1,188.00	1,254.00	− 246.00	− 180 00	− 66.00
						$4,735.50	$4,909.50	$4,910.00	−$174.50	−$174.00	−$ .50

* Represents charge to Work in Process.

FIGURE 111. Analysis of Direct Labor Variances

Department	Operation	Standard Hours Produced	Standard Hourly Rate	Actual Hours	Charge to Work in Process	Budget for Standard Hours (From Fig. 109)	Budget for Actual Hours (From Fig. 109)	Actual† Overhead (Fig. 110)	Variances			
									Total	Capacity	Efficiency	Budget
A	1 and 2	2,100	$2.25	2,110	$4,725.00	$4,642.50	$4,656.75	$4,581.00	+$144.00	+$ 82.50	−$ 14.25	+ 75.75
B	3 and 4	800	5.00	890	4,000 00	4,560.00	4,758.00	4,637.00	− 637.00	− 560.00	− 198.00	+ 121.00
					$8,725.00	$9,202.50	$9,414.75	$9,218 00	−$493.00	−$477.50	−$212.25	+$196.75
Power							$2,358.00	$2,325.00				+$ 33.00

† After service department distribution.

FIGURE 112. Manufacturing Overhead Analysis

CLOSING ENTRIES

(13)

Manufacturing Overhead—Actual	$ 33.00	
General Ledger		$ 33.00
To close balance in manufacturing overhead representing variance in Power account.		

(14)

General Ledger (Profit and Loss)	$ 2,057.50	
Manufacturing Overhead Budget Variance	196.75	
Manufacturing Overhead Capacity Variance		$ 477.50
Manufacturing Overhead Efficiency Variance		212.25
Material Price Variance		1,300.00
Material Use Variance		90.00
Direct Labor Time Variance		174.00
Direct Labor Rate Variance		.50
To close.		

(15)

General Ledger (Profit and Loss)	$15,564.50	
Cost of Sales		$15,564.50
To close.		

LEDGER ACCOUNTS

(Current Standards)

STORES

Balance	(1a)	$ 3,200.00	Work in Process	(2)	$ 8,340.00
Purchases	(1b)	27,000.00	Usage Variance	(3)	90.00
			Balance		21,770.00
		$30,200.00			$30,200.00

WORK IN PROCESS—DEPARTMENT A

Balance	(1a)	$ 600.00	Department B	(8)	$11,182.50
Stores	(2)	3,300.00	Balance		750.00
Direct Labor	(5a)	3,307.50			
Applied Overhead	(6)	4,725.00			
		$11,932.50			$11,932.50

WORK IN PROCESS—DEPARTMENT B

Balance	(1a)	$ 772.50	Finished Goods	(9)	$17,788.00
Stores	(2)	5,040.00	Balance		4,635.00
Direct Labor	(5a)	1,428.00			
Applied Overhead	(6)	4,000.00			
Department A	(8)	11,182.50			
		$22,423.00			$22,423.00

FINISHED GOODS

Balance	(1a)	$ 2,223.50	Cost of Sales	(10)	$15,564.50
Department B .	(9)	17,788.00	Balance		4,447.00
		$20,011.50			$20,011.50

COST OF SALES

Finished Goods	(10)	$15,564.50	General Ledger	(15)	$15,564.50

MANUFACTURING OVERHEAD—ACTUAL

Sundries .	(7)	$ 9,185.00	To close	(11)	$ 9,218.00
General Ledger	(13)	33.00			
		$ 9,218.00			$ 9,218.00

FACTORY PAYROLL

General Ledger	(4)	$ 9,635.00	Work in Process	(5a)	$ 4,910.00
			Manufacturing Overhead—Actual	(7)	4,725.00
		$ 9,635.00			$ 9,635.00

APPLIED MANUFACTURING OVERHEAD

Manufacturing Overhead—Actual	(11)	$ 8,725.00	Work in Process . .	(6)	$ 8,725.00

SUPPLIES INVENTORY

Balance	(1a)	$ 1,000.00	Mfg. Overhead—Actual	(7)	$ 610.00
			Balance .		390.00
		$ 1,000.00			$ 1,000.00

MATERIAL PRICE VARIANCE

General Ledger	(1b)	$ 1,300.00	General Ledger .	(14)	$ 1,300.00

MATERIAL USE VARIANCE

Stores	(3)	$ 90.00	General Ledger	(14)	$ 90.00

TOTAL DIRECT LABOR VARIANCE

Work in Process	(5a)	$ 174.50	Sundries	(5b)	$ 174.50

DIRECT LABOR TIME VARIANCE

Total D. L. Variance . . .	(5b)	$ 174.00	General Ledger	(14)	$ 174.00

DIRECT LABOR RATE VARIANCE

Total D. L. Variance	(5b)	$ .50	General Ledger	(14)	$ .50

TOTAL MANUFACTURING OVERHEAD VARIANCE

Manufacturing Overhead—Actual	(11)	$ 493.00	Sundries	(12)	$ 493.00

MANUFACTURING OVERHEAD EFFICIENCY VARIANCE

Sundries	(12)	$ 212.25	General Ledger	(14)	$ 212.25

MANUFACTURING OVERHEAD CAPACITY VARIANCE

Sundries	(12)	$ 477.50	General Ledger	(14)	$ 477.50

MANUFACTURING OVERHEAD BUDGET VARIANCE

General Ledger	(14)	$ 196.75	Total Variance	(12)	$ 196.75

GENERAL LEDGER

Sundry Variances	(14)	$ 2,057.50	Balance	(1a)	$ 7,796.00
Cost of Sales	(15)	15,564.50	Stores, etc.	(1b)	28,300.00
Balance		31,992.00	Factory Payroll	(4)	9,635.00
			Manufacturing Overhead—Actual	(7)	3,850.00
			Manufacturing Overhead—Actual	(13)	33.00
		$49,614.00			$49,614.00

In the *general ledger* the Profit and Loss account will appear as follows:

PROFIT AND LOSS

Cost of Sales	$15,564.50	Sales	$24,500.00
Variances:		*Variances:*	
Material Price	1,300.00	Manufacturing Overhead Budget	196.75
Material Usage	90.00	Power Plant	33.00
Direct Labor Time	174.00		
Direct Labor Rate	.50		
Manufacturing Overhead Capacity	477.50		
Manufacturing Overhead Efficiency	212.25		
Operating Expenses	3,000.00		
Net Profit	3,911.00		
	$24,729.75		$24,729.75

FACTORY LEDGER

TRIAL BALANCE, JANUARY 31, 19—

	Preclosing		Postclosing	
	Dr.	Cr.	Dr.	Cr.
Stores	$21,770.00		$21,770.00	
Supplies Inventory	390.00		390.00	
Work in Process—Department A	750.00		750.00	
Work in Process—Department B	4,635.00		4,635.00	
Finished Goods	4,447.00		4,447.00	
Cost of Sales	15,564.50			
Manufacturing Overhead—Actual		$ 33.00		
Material Price Variance	1,300.00			
Material Use Variance	90.00			
Direct Labor Time Variance	174.00			
Direct Labor Rate Variance	.50			
Manufacturing Overhead Efficiency Variance	212.25			
Manufacturing Overhead Capacity Variance	477.50			
Manufacturing Overhead Budget Variance		196.75		
General Ledger		49,581.00		$31,992.00
	$49,810.75	$49,810 75	$31,992 00	$31,992.00

Service Department Variances. Special comment is in order concerning service department variances. The service departments too require some determination of their efficiency. Accordingly they may be handled in a variety of ways of which only two are pertinent here:

1. Distribute actual costs of service departments
2. Distribute the fixed and variable costs of service departments on different bases

As to the first method, this would mean (Figure 110) that actual costs of $2,325 are spread over 97,000 kwh, that is, at a rate of $.02397 per kwh. This method is often used in practice. Since it leaves no balance in the service department accounts, any variances that may arise in the latter are thus automatically shifted to the producing departments.

Under the second method, service departments, like producing departments, are analyzed into their fixed and variable components at standard capacity (Figure 109). The fixed total is then distributed to the producing departments in proportion to their standard capacities. This is on the theory that the producing departments are responsible for the size (i.e., the capacity) of the service departments. Thus, in Figure 110, Departments A and B are charged $300 and $700 respectively, based on their demand for power at standard capacity. The variable charges are distributed in proportion to the *actual* consumption, *but at the standard variable rate.* The latter, as determined from Figure 109, is $.014 per kwh. The net result is that *all* fixed charges are shifted to the producing departments and will show up in the capacity variances of those departments. Moreover, because the producing departments are charged at standard rates for variable service department expenses, this leaves balances in service department accounts representing controllable or budget variances. It need hardly be added that although the illustration used in the demonstration problem is that of a power department, the same principles would apply in the case of all service departments.

PROFIT AND LOSS STATEMENT

For the Month Ended January 31, 19—

(Current Standards)

Sales			$24,500.00
Cost of Sales			
Direct Material		$ 8,340.00	
Direct Labor		4,735.50	
Manufacturing Overhead		8,725.00	
Current Manufacturing Charges		$21,800.50	
Work in Process, January 1, 19—		1,372.50	
Total Work in Process Handled		$23,173.00	
Less: Work in Process, January 31, 19—		5,385.00	
Cost of Production		$17,788.00	
Finished Goods, January 1, 19—		2,223.50	
Total Goods Available for Sale		$20,011.50	
Less: Finished Goods, January 31, 19—		4,447.00	
Cost of Sales (at standard)		$15,564.50	
Cost of Sales (at normal)			
Less: Overapplied Overhead Variances			
Material Price Variance	$1,300.00		
Material Usage Variance	90.00		
Direct Labor Time Variance	174.00		
Direct Labor Rate Variance	.50		
Manufacturing Overhead Efficiency Variance	212.25		
Manufacturing Overhead Capacity Variance	477.50		
Total Unfavorable Variances	$2,254.25		
Less: Manufacturing Overhead Budget Variance	$ 196.75		
Power Plant Variance	33.00		
Total Favorable Variances	$ 229.75		
Net Unfavorable Variances		2,024.50	
Cost of Sales (actual)			17,589.00
Gross Profit			$ 6,911.00
Operating Expenses			3,000.00
Net Income			$ 3,911.00

BALANCE SHEET

January 31, 19—

(Current Standards)

Assets		
Accounts Receivable		$24,500.00
Raw Materials		21,770.00*
Supplies Inventory		390.00
Work in Process		5,385.00*
Finished Goods		4,447.00*
Total Assets		$56,492.00
Liabilities		
Accounts Payable	$35,150.00**	
Payroll Accrued	9,635.00	
Total Liabilities		44,785.00
Net Worth		
Capital, January 1, 19—	$ 7,796.00	
Net profit for January	3,911.00	
Total Net Worth		$11,707.00

* At standard cost.

** Made up of liabilities for:

Stores	$28,300.00	
Manufacturing Overhead	3,850.00	
Operating Expenses	3,000.00	$35,150.00

QUESTIONS

1. Outline two possible methods of handling material price variances under current standards.
2. How are the three manufacturing overhead variances determined?
3. Are variances parts of total cost? Explain.
4. *a*) What basis is used for valuing inventories under a current standard cost system?
   b) Discuss its acceptability for financial accounting reporting.
5. Set forth a method for determining service department variances so that effective control of their operation is available to management.
6. A manufacturer who had installed in 1940 a standard cost accounting system, established standards at approximate December, 1939, actual costs. A steadily increasing output from 1942 to 1945 progressively lowered the actual costs and in September, 1945, they were considerably less than the 1939 standards. Discuss the advisability of downward revision of the standards.
7. Discuss the advisability of changing standards because of significant increases in price levels.
8. Compare the operation of the Work in Process account under a current standard system with Work in Process under an estimated cost system.

9. Comment on the following statement: "Where actual costs differ from estimated costs, the estimates are assumed to be wrong; when actual costs differ from standards, the actual costs are assumed to be wrong."
10. List five items entering into the cost of a manufactured product, the treatment of which in an "actual" cost system might differ in a "standard" method of determining costs and briefly describe how the amounts by which the actual costs vary from standard are treated.
11. A manufacturer of automobile accessories produces 20 items. The company has been operating under a job order system, but now wishes to develop standard costs and to use these standard costs to improve cost control and accounting methods.
    - *a*) Outline the procedure necessary to introduce standard costs.
    - *b*) Describe the operation of the cost accounts when standard costs are in use.
    - *c*) List the advantages which the company should gain from the change.

Chapter 20

OPERATION OF STANDARD COSTS—MEASUREMENT STANDARDS

Characteristics of Measurement Standards. An entirely different system from the one demonstrated in the previous chapter is presented by the so-called measurement standards. These, too, are known by different names, such as basic standards or yardstick standards. These standards are permanent and are changed only for changes in specifications and technology. They *may* be changed for substantial changes in price levels, although that is not required. The theory behind measurement standards is that prices for goods or services purchased are largely beyond the control of an individual enterprise and it therefore makes no difference whether the price incorporated in the standard is current or ten years old. The only effect of an old standard probably is to increase the size of the price variance; since, however, all that the cost accountant is after is to discover relative *efficiency* in the use of materials and labor, the price base used is immaterial.

"Under the concept of standard costs purely as measures or yardsticks, the standard cost of an article is in no respect a 'cost'; it is only an initial formula, expressed in a denomination of standard dollars and requiring adjustment by correction factors before use for costing purposes." [1] Thus for estimating purposes, in submitting quotations, the measurement standards can be adjusted to reflect current conditions by applying cost ratios in the form of index numbers to the standards for materials, labor, and manufacturing overhead. For purposes of inventory valuation or recording production costs the measurement standards are adjusted by an index reflecting the cost ratio between actual and standard recorded costs. For judging effectiveness of performance, i.e., for cost control purposes, the measurement standards may be adjusted for expected changes. All these adjustments are in the nature of memorandum items; the basic or measurement standard remains unchanged on the standard cost sheet.

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[1] Eric A. Camman, *Basic Standard Costs* (New York: American Institute Publishing Co., Inc., 1932), p. 40.

Comparison of the Two Systems. For a clearer understanding of the two systems, they may be compared with respect to the following points:

1. Establishment of physical and cost standards
2. Comparability of results for successive periods
3. Obtaining variances
4. Mechanics of bookkeeping
5. Inventory valuation

ESTABLISHMENT OF PHYSICAL AND COST STANDARDS. There is, in point of fact, no difference between the two methods concerning the setting of physical standards initially. The same care and effort go into the makeup of physical standards under either system. In converting these into standard costs, however, a notable difference appears. For current standards the prices expected to prevail during the forthcoming period for which standards are set are generally used. For measurement standards the prices used are ordinarily those prevailing at the time the standards are set; but, as already stated, these prices are fairly permanent. Current standards are expected to hold usually for a period of one year. If, as so often happens, the pressure of other duties makes it impossible to change all the standards that need changing, the result is a series of standards that are neither current nor of the measurement type. In the latter, of course, the standards need not be changed at all except as noted earlier.

COMPARABILITY OF RESULTS. From the point of view of frequency of revision, each system has its advantages and disadvantages. Current standards make possible the comparison of actual results against current, and hence attainable, standards. They make it impossible, or at least fairly difficult, to compare fluctuating actual costs of different periods with standards which themselves fluctuate. Under measurement standards, actual costs are easily compared against fixed standards for successive periods; it is therefore possible to measure the *trends* of the ratios of actual costs to standard over long periods of time. But what of measuring current performance? This may be accomplished rather easily under the measurement standard system. It is necessary only to introduce a ratio or index number showing the prices expected to prevail for the coming period. By this means it is possible to measure current effectiveness as under the current system without, however, having to change the standard cost sheets. At the same time trends can be noted as explained above.

OBTAINING VARIANCES. The above statements may most easily be tested by some figures. For example, assume the following data regarding labor costs:

Current standard labor rates	$1.50	per hour
Measurement standard labor rates	$1.20	" "
Actual rates	$1.60	" "
Standard hours in product	1,000	
Actual hours consumed	950	

In the case of *current* standards the resulting costs and variances appear as follows:

(1) Standard hours × standard rate	$1,500.00
(2) Actual hours × standard rate	1,425.00
(3) Actual hours × actual rate	1,520.00
(4) Total variance: (1) – (3)	– $20.00
(5) Time variance: (1) – (2)	+ $75.00
(6) Rate variance: (2) – (3)	– 95.00
	– $20.00

If measurement standards are used, the cost accountant at the beginning of the year makes note of the fact that labor rates are expected to rise to $1.50. Thus the ratio of expected costs for the current period to the measurement standard is 125 (i.e., $1.50 ÷ $1.20). At the end of the year he notes three facts:

(1) The index of actual to measurement standard: $1.60 ÷ $1.20	133.33⅓
(2) The index of actual to current (i.e., expected) standard: $1.60 ÷ $1.50	106.67
(3) The labor efficiency index: 950 hrs. ÷ 1,000 hrs.	95

It is now possible to compute other cost ratios and variances from measurement standards as well as variances from *current* standards.

COST RATIOS AND VARIANCES FROM MEASUREMENT STANDARDS.

(1) Charge to work in process at measurement standard: 1,000 × $1.20	$1,200.00
(2) Charge to work in process at actual cost: 950 × $1.60	$1,520.00
	A/M*
(3) Total cost ratio: $1,520 ÷ $1,200	126.67
(4) Labor time ratio (see above)	95
(5) Labor rate ratio (see above)	133.33⅓

* Ratio of actual to measurement standard.

It may be seen at once that labor bettered normal performance by 5% (i.e., 100% — 95%) but that the company paid 33⅓% above the basic or measurement standard rate. To translate these ratios into dollar amounts, it is only necessary to multiply these percentages by the base used in arriving at them.

(6) Total cost variance: 26.67% × $1,200	– $320.00
(7) Labor time variance: 5% × $1,200	+ $ 60.00
(8) Labor rate variance: 33⅓% × $1.20 × 950 hrs. = 33⅓% × $1,140	– 380.00
	– $320.00

Calculations (6), (7), and (8) above have been carried out merely to show that the variances can be computed from the cost ratios. Actually this is a clumsy method. Anyone interested in the dollar variances can obtain them more directly, as follows:

Total cost variance: $1,200 – $1,520	– $320.00
Labor time variance: 50 hrs. less than standard at $1.20	+ 60.00
Labor rate variance: $.40 (in excess of measurement standard) × 950 hrs.	– 380.00
	– $320.00

COST RATIOS AND VARIANCES FROM EXPECTED STANDARDS.

(1) Labor time ratio (see above)	95
(2) Labor rate ratio (see above)	106.67
	A/C*
(3) Total cost ratio: 106.67 × 95	101.33⅓**

* Ratio of actual to current standard.

** This can also be computed from dollar amounts·

Charge to work in process at expected standard: 1,000 × $1.20 × 125%	$1,500.00
Actual cost· 950 × $1.60	1,520.00
Ratio of actual to standard: $1,520 ÷ $1,500	101.33⅓

In this case it is evident that labor efficiency is the same as in the previous calculation, but the rate variance is only 6.67% above standard because it is measured against a higher base. These variances may again be translated into dollar amounts:

(4) Total cost variance: 1.33⅓ × $1,200 × 125%	– $20 00
(5) Labor time variance: 5% × $1,200 × 125%	+ $75.00
(6) Labor rate variance: 6.67% × $1.50 × 950 hrs.	– 95.00
	– $20.00

Note that these figures are exactly the same as those obtained under the *current* standard system. This is because the measurement standards were adjusted to reflect current conditions. However, by comparing the last two methods, it may be seen that though the labor time index is the same in both cases (95%), the dollar amounts differ because in one case the percentage is applied to measurement dollars, in the other to current dollars. These two can easily be reconciled by multiplying the time variance obtained from measurement standards by the index of expected labor rates:

5% of $1,200 = $60.00
$60 × 125% = $75.00

The latter figure agrees with the results in the preceding paragraph. In fact, the quickest way to obtain it is evidently to take the variance obtained in the first method and adjust it for the expected change in rates.

To summarize, the variances obtained under measurement standards may be the same as those obtained under the current standard system, if the former are adjusted through the application of an appropriate index number in order to reflect current price levels. However, under current standards the variances are incorporated in the accounts whereas under measurement standards they must be separately calculated and do not appear in the accounts except in the form of over- or underapplied expense.

MECHANICS OF BOOKKEEPING. The distinctive feature of the measurement standard system is that the cost controls are debited and credited at *both* actual and standard costs. The procedure is to charge Stores at actual and standard costs, obtained, respectively, from invoices and standard cost sheets. A ratio of actual to standard costs is then obtained from the debit totals of the account. Material issues are credited to Stores at measurement standards. They are converted to actual costs by multiplying the standard cost by the ratio obtained on the contra side. Both actual and standard costs are thus credited to Stores.

The same procedure is followed in Work in Process and Finished Goods. The debit sides yield cost ratios or indexes obtained from the usual source documents. Transfers from Work in Process to Finished Goods and from Finished Goods to Cost of Sales are made at measurement standard and at actual costs, the latter being obtained by multiplying the standard by the appropriate cost ratio.

It must be understood that the financial accounts are kept in the conventional manner. In addition it is necessary to introduce a new account called Standard Balance Control. This account makes possible the preparation of a four-column trial balance at *actual and at standard.* It is an offsetting or balancing account used whenever no other account can take an offsetting debit or credit. In the preparation of the financial statements it is simply omitted. On the factory ledger, the balance of the account represents the sum of the balances in the inventory controlling accounts.

INVENTORY VALUATION. The reason the Standard Balance Control may be omitted from the statements without disturbing their equilibrium is that the inventories appear at actual costs. In short, *all* standards disappear from the statements, except for the standard overhead which has been incorporated in the inventories. This implies naturally that inventories appear in the statements at *actual* cost. The word "actual," however, does not convey the real meaning. A more accurate description would be that inventories are valued at "computed actual" costs.

These values are arrived at, as was seen above, by multiplying the standard value by the appropriate cost index.

It is at this point that the difficulty of the system appears. For example, the Stores account may control many thousands of items appearing on stock ledger cards. Many of these items exhibit different types of price behavior. Some move up 5% while others move up 10% in price and still others decline in price at varying percentages. The effect of the index in converting standard to actual costs is to average out the fluctuations over *all* materials issued. The suggestion has been made, therefore, that materials be grouped according to similarity of price behavior; that separate material controls, for example, be established for all materials that have increased 5% in price, another control for those showing price increases of from 5% to 10%, etc. The same principle of grouping would apply to items showing price declines. Undoubtedly this scheme increases the accuracy of the computed actual costs, but it also complicates the bookkeeping procedure, especially if some of the items within a group begin to show different price tendencies from the other items in the same group. This would require a regrouping of materials with all the attendant nuisance.

Illustration of Measurement Standard Cost System. In the succeeding pages the same set of transactions used to illustrate current standard cost keeping is applied to measurement standard technique. The standards used are the same in both cases, although after the first year of operations there are likely to be divergences between the two. In the illustrations given, the entries at actual and at standard cost have been separated (Entries 1b and 1c, 3a and b, 5a and b, 6a and b, 8a and b, 9a and b). In each case, a compound entry could, of course, be made to record both actual and standard costs.

Work in Process Treatment. It should be noted that only two work in process accounts are kept, one for each department. Since each account is charged for material, labor, and overhead and only one cost ratio is obtained for each account, a certain amount of averaging takes place and to that extent limits the validity of the resulting cost ratios. The remedy is to subdivide each work in process account into appropriate elements. But this would mean six accounts for the two departments, thirty if there were ten producing departments. A point is obviously reached where the results are not worth the clerical effort required to produce them.

A common method often used in practice is to classify products into groups with a work in process account and variance accounts for each group.

One further comment is necessary in connection with Entries (3a) and (3c). These cover the excess material requisition which is charged to Work in Process at actual cost *only,* the standard charge being made to Standard Balance Control.

Treatment of Manufacturing Overhead. Under measurement standards this involves three sets of entries:

1. A charge to work in process for the standard hours in the product at the standard rate, the offsetting credit being Standard Balance Control
2. A charge to work in process for the actual hours at the standard rate, the offsetting credit being Applied Manufacturing Overhead
3. A charge to Manufacturing Overhead—Actual, obtained from the customary sources

Note that at no time is Work in Process charged for actual expenses, not even in the actual cost column.

In Entry (7b), service department expenses have been distributed exactly as in Entry (7b) for current standards and for the same reason. Unabsorbed overhead balances (difference between actual and applied expenses) are closed into Profit and Loss as shown by the Profit and Loss account in the general ledger. If preferred, these overhead balances may be deferred or they can be distributed to inventories and cost of sales, for the use of measurement standard costs need not alter the company's practice in this respect.

Standard Balance Control. This account, as already stated, is purely a balancing account. In the trial balance it appears at $31,602. It is immediately apparent that this represents the standard cost of all inventories except the supplies inventory which is kept at actual cost.

Ledger Accounts. In order to avoid excessive arithmetic, the cost ratios are computed to two decimals only. Since this involves some inaccuracy, the cost transfers are computed to the nearest dollar. Consequently the inventories at the end, in the actual cost column, are best obtained by direct subtraction rather than by the application of the cost ratio to the standard. Thus in the Stores account, the computed actual cost of the closing inventory is $22,564 which is the amount necessary to bring the actual cost columns in the account into agreement. The cost index used was 103.64; in order to produce the above actual cost an index of 103.6425 would have to be used.

JOURNAL ENTRIES

(Measurement Standards)

	Actual		Standard	
	Dr.	Cr.	Dr.	Cr.
(1a)				
Stores	$ 3,000.00		$ 3,200.00	
Supplies Inventory	1,000.00		–	
Work in Process—Department A	625.00		600.00	
Work in Process—Department B	750.00		772.50	
Finished Goods	2,100.00		2,223.50	
General Ledger		$ 7,475.00		
Standard Balance Control				$ 6,796.00
To record opening inventories at actual and at standard costs. The balances are carried to the General Ledger at actual cost and to Standard Balance at standard cost.				
(1b)				
Stores	$28,300.00			
General Ledger		$28,300.00		
To charge raw material account at actual cost of purchases.				
(1c)				
Stores			$27,000.00	
Standard Balance Control				$27,000.00
To charge raw material account at standard cost of purchases.				
(2)				
Work in Process—Department A			$ 3,300.00	
Work in Process—Department B			5,040.00	
Stores				$ 8,340.00
To charge work in process at standard cost of standard quantity of material used.				
(3a)				
Standard Balance Control			$ 90.00	
Stores				$ 90.00
To record issue of material to Department A in excess of standard.				
(3b)				
Work in Process—Department A	$ 3,420.00			
Work in Process—Department B	5,223.00			
Stores		$ 8,643.00		
To record charge to work in process at actual cost of standard quantity used (see Stores account). Dept. A: $3,300 × 103.64 $3,420.00 Dept. B: $5,040 × 103.64 5,223.00 $8,643.00				
(3c)				
Work in Process—Department A	$ 93.00			
Stores		$ 93.00		
To record actual cost of excess material issued to Department A (see Stores account): $90.00 × 103.64 = $93.00				
(4)				
Factory Payroll	$ 9,635.00			
General Ledger		$ 9,635.00		
To record actual payroll.				
(5a)				
Work in Process—Department A	$ 3,242.00			
Work in Process—Department B	1,668 00			
Factory Payroll		$ 4,910.00		
To charge work in process for actual cost of direct labor.				

	Actual		Standard	
	Dr.	Cr.	Dr.	Cr.
(5b)				
Work in Process—Department A			$ 3,307.50	
Work in Process—Department B			1,428.00	
Standard Balance Control				$4,735.50
To charge work in process for standard cost of direct labor used.				
(6a)				
Work in Process—Department A	$ 4,747.50			
Work in Process—Department B	4,450.00			
Applied Manufacturing Overhead		$ 9,197.50		
To charge production for actual hours worked at *standard* rates:				
Dept. A: 2,110 hrs. × $2.25 = $4,747.50				
Dept. B: 890 hrs. × $5.00 = 4,450.00				
$9,197.50				
(6b)				
Work in Process—Department A			$ 4,725.00	
Work in Process—Department B			4,000.00	
Standard Balance Control				$ 8,725.00
To charge production for standard hours worked at standard rates:				
Dept. A: 105 units × 20 hrs. × $2.25 = $4,725.00				
Dept. B: 80 units × 10 hrs. × $5.00 = $4,000.00				
(7a)				
Manufacturing Overhead—Actual	$ 9,185.00			
Factory Payroll		$ 4,725.00		
Supplies Inventory		610 00		
General Ledger		3,850.00		
(7b)				
Manufacturing Overhead—Actual	$ 2,358.00			
Manufacturing Overhead—Actual		$ 2,358.00		
To record distribution of power cost on basis of fixed stand-by cost plus *standard* variable charge (see Figure 110).				
(8a)				
Work in Process—Department B			$11,182.50	
Work in Process—Department A				$11,182.50
Transfer of 105 units at standard cost from Department A to Department B:				
Material $ 30.00				
Direct Labor 31.50				
Manufacturing Overhead 45 00				
$106.50				
105 × $106.50 = $11,182.50				
(8b)				
Work in Process—Department B	$11,365.00			
Work in Process—Department A		$11,365.00		
To record transfer of 105 units at actual cost obtained from cost ratio (see Work in Process account for Department A):				
$11,182.50 × 101.63 = $11,365.00				
(9a)				
Finished Goods			$17,788.00	
Work in Process—Department B				$17,788.00
To transfer standard cost of 80 units completed by Department B:				
80 × $222.35 = $17,788.00				

	Actual		Standard	
	Dr.	Cr.	Dr.	Cr.
(9b)				
Finished Goods	$18,608.00			
Work in Process—Department B		$18,608.00		
To transfer actual cost of 80 units completed by Department B (see Work in Process account for Department B):				
$17,788 × 104.61 = $18,608.00				
(10a)				
Standard Balance Control			$15,564.50	
Finished Goods				$15,564.50
To record shipment of 70 units at standard cost:				
70 × $222.35 = $15,564.50				
(10b)				
Cost of Sales	$16,106.00			
Finished Goods		$16,106.00		
To record actual cost of sales of 70 units shipped (see Finished Goods account).				
$15,564.50 × 103.48 = $16,106.00				
(11)				
Applied Manufacturing Overhead	$ 9,197.50			
Total Manufacturing Overhead Variance		$ 12.50		
Manufacturing Overhead—Actual		9,185.00		
To close actual against applied overhead and record underapplied overhead.				
(12)				
Total Manufacturing Overhead Variance	$ 12.50			
General Ledger		$ 12.50		
To close former account.				
(13)				
General Ledger (Profit and Loss)	$16,106.00			
Cost of Sales		$16,106.00		
To close.				

PRECLOSING TRIAL BALANCE

Stores	$22,564.00		$21,770.00	
Supplies Inventory	390.00			
Work in Process—Department A	762.50		750.00	
Work in Process—Department B	4,848.00		4,635.00	
Finished Goods	4,602.00		4,447.00	
Cost of Sales	16,106.00			
Manufacturing Overhead—Actual	9,185.00			
Manufacturing Overhead—Applied		$ 9,197.50		
General Ledger		49,260.00		
Standard Balance Control				$31,602.00
	$58,457.50	$58,457.50	$31,602.00	$31,602.00

POSTCLOSING TRIAL BALANCE

Stores	$22,564.00		$21,770.00	
Work in Process—Department A	762.50		750.00	
Work in Process—Department B	4,848.00		4,635.00	
Finished Goods	4,602.00		4,447.00	
Supplies Inventory	390.00			
General Ledger		$33,166.50		
Standard Balance Control				$31,602.00
	$33,166.50	$33,166.50	$31,602.00	$31,602.00

STORES

		Actual	Ratio	Standard			Actual	Ratio	Standard
Balance	(1a)	$ 3,000.00	93.75	$ 3,200.00	Issues to Work in Process—A	(3b) (2)	$ 3,420.00	103.64	$ 3,300.00
Purchases	(1b) (1c)	28,300.00		27,000.00	Issues to Work in Process—B	...	5,223.00	103.64	5,040.00
					Excess Material—Department A	(3c) (3a)	93.00	103.64	90.00
					Balance		22,564.00		21,770.00
		$31,300.00	103.64	$30,200.00			$31,300.00		$30,200.00

WORK IN PROCESS—DEPARTMENT A

		Actual	Ratio	Standard			Actual	Ratio	Standard
Balance	(1a)	$ 625.00	104.17	$ 600.00	Transfer to Department B	(8b) (8a)	$11,365.00	101.63	$11,182.50
Stores	(3b) (2)	3,420.00		3,300 00	Balance		762.50		750.00
Stores (excess material)		93.00		–					
Direct Labor	(5a) (5b)	3,242.00		3,307.50					
Applied Manufacturing Overhead	(6a) (6b)	4,747.50		4,725.00					
		$12,127 50	101.63	$11,932.50			$12,127.50	101.63	$11,932.50

WORK IN PROCESS—DEPARTMENT B

		Actual	Ratio	Standard			Actual	Ratio	Standard
Balance	(1a)	$ 750.00	90.71	$ 772.50	Finished Goods	(9b) (9a)	$18,608.00	104 61	$17,788.00
Stores	(3b) (2)	5,223 00		5,040.00	Balance		4,848.00		4,635.00
Direct Labor	(5a) (5b)	1,668.00		1,428.00					
Applied Manufacturing Overhead	(6a) (6b)	4,450.00		4,000.00					
Transfer from Department A	(8b) (8a)	11,365.00		11,182.50					
		$23,456 00	104 61	$22,423 00			$23,456.00	104.61	$22,423.00

FINISHED GOODS

		Actual	Ratio	Standard			Actual	Ratio	Standard
Balance	(1a)	$ 2,100.00	105.88	$ 2,223.50	Cost of Sales	(10b) (10a)	$16,106.00	103.48	$15,564.50
Transfer from Department B	(9b) (9a)	18,608.00		17,788.00	Balance		4,602.00		4,447.00
		$20,708.00	103.48	$20,011.50			$20,708.00	103.48	$20,011.50

COST OF SALES

Finished Goods	(10b)	$16,106.00	General Ledger	(13)	$16,106.00

STANDARD BALANCE CONTROL

Stores	(3a)	$ 90.00	Balance	(1a)	$ 6,796.00
Finished Goods	(10a)	15,564.50	Stores	(1c)	27,000.00
Balance		31,602.00	Work in Process (Labor)	(5b)	4,735.50
			Work in Process (Overhead)	(6b)	8,725.00
		$47,256.50			$47,256.50

GENERAL LEDGER

Cost of Sales	(13)	$16,106.00	Balance	(1a)	$ 7,475.00
Balance		33,166.50	Stores	(1b)	28,300.00
			Payroll	(4)	9,635.00
			Manufacturing Overhead	(7a)	3,850.00
			Overapplied Manufacturing Overhead	(12)	12.50
		$49,272.50			$49,272.50

FACTORY PAYROLL

General Ledger	(4)	$ 9,635.00	Work in Process	(5a)	$ 4,910.00
			Manufacturing Overhead—Actual	(7a)	4,725.00
		$ 9,635.00			$ 9,635.00

APPLIED MANUFACTURING OVERHEAD

Actual Manufacturing Overhead	(11)	$ 9,197.50	Work in Process	(6a)	$ 9,197.50

ACTUAL MANUFACTURING OVERHEAD

General Ledger	(7b)	$ 2,358.00	Applied Manufacturing Overhead	(7b)	$ 2,358.00
	(7a)	9,185.00		(11)	9,185.00
		$11,543.00			$11,543.00

SUPPLIES INVENTORY

Balance	(1a)	$ 1,000.00	Manufacturing Overhead	(7a)	$ 610.00
			Balance		390.00
		$1,000.00			$1,000.00

	M—1	M—2	M—3	Total
1. *Total Cost Ratios*				
Formula: $\frac{\text{Actual Quantity} \times \text{Actual Cost}}{\text{Standard Quantity} \times \text{Standard Cost}}$	$\frac{570 \times \$2.00 \times 1.0364}{550 \times \$2.00}$	$\frac{225 \times \$10.00 \times 1.0364}{220 \times \$10.00}$	$\frac{1.260 \times \$4.00 \times 1.0364}{1,260 \times \$4.00}$	$\frac{\$1.181 + \$2,332 + \$5,223}{\$1,100 + \$2,200 + \$5.040}$
	= $\frac{\$1.181}{\$1.100}$	= $\frac{\$2,332}{\$2,200}$	= $\frac{\$5.223}{\$5,040}$	= $\frac{\$8,736}{\$8,340}$
	= 107.36	= 106.00	= 103.63	= 104.75
Total Variances	— .0736 × $1,100 — $81.00	— .06 × $2.200 — $132.00	— .0363 × $5.040 — $183 00	— .0475 × $8,340 — $396 00
2. *Material Price Ratios*				
Formula: $\frac{\text{Actual Quantity} \times \text{Actual Cost}}{\text{Actual Quantity} \times \text{Standard Cost}}$				
These ratios have already been calculated (see credit side of Stores account).	103.64	103.64	103.64	103.64
Material Price Variance	— .0364 × $1,140 — $42.00	— .0364 × $2,250 — $82.00	— .0364 × $5,040 — $183 00	— .0364 × $8,430 — $307.00
3. *Material Use Ratio*				
Formula: $\frac{\text{Total Cost Ratio}}{\text{Price Ratio}}$	$\frac{107.36}{103.64}$	$\frac{106.00}{103.64}$	$\frac{103.64}{103.64}$	$\frac{104.75}{103.64}$
	= 103.60	= 102.28	100.00	101.07
or				
$\frac{\text{Actual Quantity} \times \text{Standard Cost}}{\text{Standard Quantity} \times \text{Standard Cost}}$	$\frac{570 \times \$2.00}{550 \times \$2.00}$	$\frac{225 \times \$10.00}{220 \times \$10.00}$	$\frac{1.260 \times \$4.00}{1,260 \times \$4.00}$	$\frac{\$8,430}{\$8,340}$
	= 103 60	= 102.27	100.00	101 08
Material Use Variance .	— .0360 × $1,100 — $40.00	— .0227 × $2,200 — $50.00	— 0	— .0108 × $8,340 — $90.00

FIGURE 113. Material Cost Ratios and Variances

TOTAL MANUFACTURING OVERHEAD VARIANCE

General Ledger (P&L) (12)	$ 12.50	Applied Manufacturing Overhead .. (11)	$ 12.50

PROFIT AND LOSS ACCOUNT
(in General Ledger)

Cost of Sales	$16,106.00	Sales .	$24,500.00
Operating Expense	3,000.00	Overapplied Manufacturing Overhead	12.50
Net Profit . .	5,406.50		
	$24,512.50		$24,512.50

Cost Ratios. As explained earlier in the chapter, cost ratios are related to each other by the following general formula:

$$\text{Total cost ratio} = \text{Price ratio} \times \text{Use ratio}$$

This means that if any two of these ratios are known, the third can be found directly:

$$\text{Price ratio} = \frac{\text{Total cost ratio}}{\text{Use ratio}}$$

$$\text{Use ratio} = \frac{\text{Total cost ratio}}{\text{Price ratio}}$$

For example, in Figure 113 the total cost ratio is obtained by the usual formula. The material price ratio is already known from the Stores account and the material use ratio can therefore be quickly established by dividing the total cost ratio by the price ratio.

Another point to be noted is the fact that cost ratios can frequently be computed on the basis of unit costs rather than total dollar amounts. They may even be computed from physical coefficients, such as hours, without any dollar value being involved. Figure 114 furnishes examples of both. The labor rate ratios can be computed directly by comparing the actual hourly rate with the standard hourly rate. The labor time ratio is most readily found by a comparison of the actual hours with the standard hours in the product.

Figure 115 presents the overhead cost ratios and variances. Comparison with the corresponding exhibit in Chapter 19 (Figure 112) reveals the same variances in both cases except for the capacity variance. This is inevitable because of the difference in computing the charge to Work in Process. Under measurement standards the charge (in the actual cost column) represents the *actual* hours at the standard overhead rate; in the case of current standards, the charge represents the *standard* hours at the standard rate.

	Operation 1	Operation 2	Operation 3	Operation 4	Total
1. *Total Cost Ratios*					
Formula.					
Actual Hours × Actual Rate	570 × $1.50	1 540 × $1 55	230 × $1 80	660 × $1.90	
Standard Hours × Standard Rate	525 × $1 50	1,575 × $1.60	240 × $1 75	560 × $1.80	
	= $855 00	= $2,387	$414	$1,254	$4,910.00
	$787 50	$2,520	$420	$1,008	$4,735 50
	= 108 57	= 94 72	98 57	124 40	103 68
Total Labor Variance	− 0857 × $787 50	+ .0528 × $2,520	+ .0143 × $420	− .2440 × $1,008	− .0368 × $4,735.50
	− $67 00	+ $133 00	+ $6 00	− $246.00	− $174.00
2 *Labor Rate Ratios*					
Formula·					
Actual Rate	$1.50	$1 55	$1.80	$1 90	$4,910 00*
Standard Rate	$1 50	$1 60	$1.75	$1 80	$4,909.50
	= 100 00	= 96 88	= 102 86	= 105.56	100 02
Labor Rate Variance	-	+ .0312 × 1,540 × $1 60	− 0286 × 230 × $1 75	− 0556 × 660 × $1.80	− 0002 × $4,909
	-	+ $77 00	− $12 00	− $66 00	− $1 00
3. *Labor Time Ratios*					
Formula					
Actual Hours	570	1,540	230	660	$4,909 50*
Standard Hours	525	1,575	240	560	$4,735.50
	= 108.57	97.78	95.84	117 86	103 68
Labor Time Variance	− .0857 × 525 × $1 50	+ 0222 × 1,575 × $1 60	+ .0416 × 240 × $1 75	− .1786 × 560 × $1.80	− .0368 × $4,735.50
	− $67 00	+ $56 00	+ $17.00	− $180.00	− $174.00

* Taken from labor costs in Work in Process accounts.

FIGURE 114. Direct Labor Cost Ratios and Variances

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
					Cost Ratios				Variances**			
Department	Actual Hours × Standard Rate	Budget for Standard Hours*	Budget for Actual Hours*	Actual Overhead	Total (5) ÷ (2)	Capacity (3) ÷ (2)	Efficiency (4) ÷ (3)	Budget (5) ÷ (4)	Total	Capacity	Efficiency	Budget
A ..	$4,747.50	$4,642 50	$4,656.75	$4,581.00	96 49	99.79	100.31	98.37	+$166.50	+$105.00	—$ 14.25	+$ 75.75
B . .	4,450.00	4,560.00	4,758.00	4,637.00	104.20	102 47	104.34	97.46	— 187.00	— 110.00	— 198.00	+ 121 00
	$9,197.50	$9,202.50	$9,414.75	$9,218.00					—$ 20.50	—$ 5 00	—$212.25	+$196.75
Power			$2,358 00	$2,325.00					+ 33.00			+ 33.00
									+$ 12.50	—$ 5 00	—$212.25	+$229.79

* Obtained from Figure 112.

** Obtained as usual by direct subtraction. Can also be obtained by application of variance ratios to bases used.

FIGURE 115. Net Over- or Underapplied Manufacturing Overhead Cost Ratios and Variances

PROFIT AND LOSS STATEMENT

For the Month Ended January 31, 19—

(Measurement Standards)

Sales		$24,500.00
Cost of Sales		
Direct Material	$ 8,736.00	
Direct Labor	4,910.00	
Manufacturing Overhead	9,197.50	
Current Manufacturing Charges	$22,843.50	
Work in Process, January 1, 19—	1,375.00	
Total Work in Process Handled	$24,218.50	
Less: Work in Process, January 31, 19—	5,610.50	
Cost of Production	$18,608.00	
Finished Goods, January 1, 19—	2,100 00	
Total Finished Goods Available for Sale	$20,708.00	
Less: Finished Goods, January 31, 19—	4,602.00	
Cost of Sales (normal)	$16,106 00	
Less: Overapplied Overhead	12.50	
Cost of Sales (actual)		16,093.50
Gross Profit		$ 8,406.50
Operating Expenses		3,000.00
Net Income		$ 5,406.50

BALANCE SHEET

January 31, 19—

(Measurement Standards)

Assets		
Accounts Receivable	$24,500.00	
Raw Materials	22,564.00*	
Supplies Inventory	390.00	
Work in Process	5,610.50*	
Finished Goods	4,602.00*	
Total Assets		$57,666.50
Liabilities		
Accounts Payable	$35,150.00**	
Payroll Accrued	9,635.00	
Total Liabilities		$44,785.00
Net Worth		
Capital, January 1, 19—	$ 7,475.00	
Net Profit for January	5,406 50	$12,881.50

* At actual cost.

** Made up of liabilities for:

Stores	$28,300.00
Manufacturing Overhead	3,850.00
Operating Expenses	3,000.00
	$35,150.00

Comparison of Current and Measurement Standard Cost Systems. Because Work in Process is charged and credited at standard, the *current* standard cost method has, as its principal advantages, the promptness with which variances from standard costs are disclosed, simplicity and economy with which accounts are operated, and the ability to provide analysis of variances in as much detail as the management may desire. It is based primarily upon the theory that standard costs are real costs suitable for inclusion in the financial statements. It is, however, possible to close the variance accounts into Cost of Sales and inventories for the purpose of stating these items at actual cost, although distribution of variance balances is apt to be a rather rough estimate. The method of variance disposal does not, of course, affect the detailed assignment of responsibility for variances before the goods reach the finished stage. It is for the above reasons that this plan, with modifications to meet individual plant requirements, is probably the most common.

The measurement standard system provides essentially the same information as the current standard plan, but has as its principal feature the use of *percentages* rather than amounts. In comparison with the current standard plan, it is not so effective in providing variance data with promptness because it is necessary to complete the entries and compute the ratios before actual performance can be compared with standards. In contrast with the current standards plan this is based upon the theory that only actual costs should be carried into the financial statements and standard costs are accordingly cleared from the books as soon as they have served their purpose as aids to control of manufacturing operations.

Against these advantages must be set certain limitations of the measurement standard system:

1. It is more *complex* and thus more difficult to understand than the other method.
2. While much labor can be saved by grouping items and computing such individual costs as may be desired by applying ratios to measurement standards, the real details are sacrificed in the process of of averaging which produces the ratios. Much care must be used in designing the system to avoid obscuring important differences in cost and emphasizing others of small consequence. In order to preserve these details a sufficiently large number of control accounts must be carried in the factory ledger. Here again it is a question of the amount of detail desired. Every detail is available for control if desired, but some grouping must be done under any plan to condense the voluminous data into some intelligible form.
3. The measurement standard plan may involve more clerical work than the current standard plan because parallel entries at both standard and actual cost must be made.

4. Since comparisons with measurement standards do not provide good measures of *efficiency,* it is necessary to use a second set of standards representing current performance. This double set of standards, each of which has a different meaning, may be confusing to those who use the figures and also involves a certain amount of additional work in setting the standards.

QUESTIONS

1. Compare measurement and current standards under conditions of rapidly changing price levels.
2. Compare the bases for inventory valuation for material, labor, and manufacturing overhead in a job order system as against a measurement standard cost system.
3. Explain the function of the Standard Balancing Control account in a system of measurement standards.
4. Comment on the reality of costs derived from a system of measurement standards wherever ratios are applied to standard costs to give actual costs.
5. Contrast the recording of variances in the accounts under a system of measurement standards and current standards.
6. Compare the two standard cost systems with respect to evaluation of costs over successive periods of time.
7. Explain how measurement standards can be used to yield variance results identical with those produced by current standard variance analysis.
8. What advantage is there in having separate work in process accounts for material, labor, and overhead under measurement standards?
9. What are the purposes of cost ratios under a measurement standard system?
10. Assume the following data:

Material X-10—	Actual quantity used	200 lbs.
	Standard allowed quantity	180 lbs.
	Actual unit cost	$2.30
	Standard unit cost	$2.50

Find the total ratio, the material price ratio, and the material use ratio. Derive the dollar variances from these ratios.

Chapter 21

BY-PRODUCTS AND JOINT PRODUCT COSTS

Importance of Joint Costs in Industry. Joint costs occur under two different conditions:

1. Joint overhead costs representing the cost of services which are to be apportioned to various departmental accounts
2. Joint production costs where the processing of the raw material produces a variety of products

It is the second of the above conditions which forms the scope of this chapter.

One of the problems of the production engineer is the complete utilization of the raw material. An inevitable accompaniment of the production process is the appearance of waste and scrap. The trend of modern production is all in the direction of the elimination of such waste and to obtain a 100% yield from the raw material. Such yield may not be all in the form of one product, but the effort of management is directed toward obtaining 100% utility, if necessary through a variety of products, each of which represents a commercially useful item.

By-Products

By-Product Defined. A by-product is an article of value incidental to the manufacture of the main product or else it may be made from waste material arising from such manufacture. A line is frequently drawn between by-products, waste, spoilage and scrap. Waste is that portion of basic raw material lost in processing, having no recovery value. Some companies have through research converted what was unsalable waste to a revenue yielding by-product.

Spoilage is the defective portion of regular production having a value only recoverable through reprocessing. Scrap is the incidental residue from certain types of manufacture recoverable without further processing. The principal difference between scrap and a by-product is one of degree of value.

Illustrations of By-Products. The following are typical examples of by-products:

1. Cottonseed accompanying cotton. The seed was formerly thrown away or used only as fertilizer; it is now the basis of a great oil and oil cake industry.
2. The bagasse from the grinding of sugar cane, formerly a waste product, is now used to make wallboard.
3. The molasses left as a residuum in the making of sugar, formerly wasted for the most part, is now the raw material for industrial alcohol.
4. In the manufacture of coke, there are found such residuals as sulphate of ammonia, coal tar, benzol, and gas, plus many others, all of which can be considered as by-products.
5. In the flour milling industry, the production of high-grade flour is accompanied by the production of low-grade flour, mill-feed and bran.
6. In the dairy industry, the production of butter and cheese is accompanied by the production of buttermilk and whey.
7. Packinghouse by-products are of two kinds, edible and inedible. The edible products prepared from hearts, livers, brains, ox tails, kidneys, sweetbreads, and tongues are obtained in the slaughter of livestock. The inedible products are subdivided into a number of representative classes. Hides, skins, and pelts are processed into leather, wool, curled hair, and other products; fats into tallows and greases; glands into pharmaceutical products; bones, blood, and scraps into animal feed, fertilizer material, and various other products.

Accounting for By-Products. There are several generally accepted methods of accounting for by-products:

1. Net sales of by-products treated as "Other Income" on profit and loss statement
2. Total sales less total costs
3. Total costs less revenue from sale of by-products
4. Total costs less net yield from by-products

Other Income Method. This procedure requires that net sales of by-products be closed to the profit and loss account. The formal profit and loss statement would classify these net sales as "other income" or "miscellaneous income." While this method can hardly be called a cost method, it is justified where the value of the by-product is relatively unimportant, where the use of a more detailed method would entail accounting costs disproportionate to the benefits derived or where no clearly defined basis of separating the by-product from the main product exists.

Generally, no value is given to by-product inventories under this method. This results in an overstatement of major product inventories. Further, the absence of any method of inventory control of by-products may lead to losses due to fraud and mismanagement. An illustrative profit and loss statement for a situation employing this method follows (Figure 116):

Sales of main product (1,000 units at $10)		$10,000.00
Cost of sales		
Produced (1,200 units at $8)	$9,600.00	
Less inventory of main product (200 units at cost, 1/6 of production cost)	1,600.00	8,000.00
Gross profit		$ 2,000.00
Selling and administrative expense		500.00
Operating income		$ 1,500.00
Other income:		
By-product sales (1,000 units at $.60)		600.00
Income for period		$ 2,100.00*

* For purposes of illustration it is assumed that there is also a by-product inventory which would appear as a footnote to the balance sheet.

FIGURE 116. Other Income Method

Total Sales Less Total Cost. This is a mere modification of the other income method, the only difference being the inclusion of sales of by-product with major product sales and the deduction of joint manufacturing and other costs from the total revenue to derive net income (Figure 117).

Sales of all products:		
1,000 units main product at $10	$10,000.00	
1,000 units by-product at $.60	600.00	$10,600.00
Cost of sales (as in first illustration)		8,000.00
Gross profit		$ 2,600.00
Selling and administrative expense		500.00
Net income for period		$ 2,100.00†

† For purposes of illustration it is assumed that there is also a by-product inventory which would appear as a footnote to the balance sheet.

FIGURE 117. Total Sales Less Total Cost Method

Total Cost Less Revenue from Sale of By-Product. Here the proceeds from the sale of the by-product are treated as a reduction in the cost of the main product. This method is illustrated in Figure 118. The net income as indicated is different from that yielded in the previous two methods since the treatment of by-product sales results in a lower total cost of production and therefore a different base on which to calculate the inventory value of the main product.

Sales of main product (1,000 units at $10)		$10,000.00
Cost of sales:		
Produced (1,200 units at $8)	$9,600.00	
Less by-product sales (1,000 units at $.60)	600.00	
Net cost of major product	$9,000.00	
Less inventory major product (200 units at cost, 1/6 of net cost)	1,500.00	7,500.00
Gross profit		$ 2,500.00
Selling and administrative expense		500.00
Net profit		$ 2,000.00*

* For purposes of illustration it is assumed that there is also a by-product inventory which would appear as a footnote to the balance sheet.

FIGURE 118. Total Sales Less By-Product Revenue

Total Costs Less Net Yield from By-Products. This method goes a step beyond the methods previously described. To understand it reference is made to Figure 119. Up to a certain point all costs are incurred jointly; in the diagram this is represented by the line *AB*. After that point, separate costs may be quite easily determined for each product. These are called subsequent costs. The point of separation (*B*) is known as the split-off point. At this point the individual products emerge and are identified. The subsequent costs are incurred to make the respective products marketable.

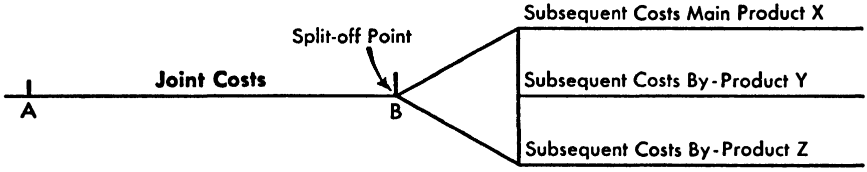
Subsequent Costs Main Product X
Split-off Point
Joint Costs
Subsequent Costs By-Product Y
A
B
Subsequent Costs By-Product Z

FIGURE 119. Diagram of Joint and Individual Costs

Under the method contemplated here, the cost of the sales of the main product takes into account the net yield from the residuals. The latter in turn is made up of the sum of sales and inventory values minus subsequent costs including a share of marketing and general administrative expenses.

In Figure 120 it is assumed that the joint cost is $8,500, and the subsequent costs are $500 for the main product and $600 for the by-product. These figures make up the total production cost, which is therefore the same as in previous illustrations. Since the joint cost is charged entirely to the main product, the by-product inventory, when valued at cost, carries only subsequent costs. Thus the unit by-product inventory value is $600 divided by 2,500 units, or 24 cents. This is the figure used in valuing the inventory of the by-product in the illustration. Note that the by-product inventory in the illustration has been taken up on the books.

Sales main product (1,000 units at $10)		$10,000.00
Cost of sales:		
Joint cost (charged to main product) (1,200 units)	$8,500.00	
Subsequent costs main product (1,200 units)	500.00	
Total charges to main product	$9,000.00	
Less net yield from by-product (Schedule 1)	280.00	
Net production cost of main product (1,200 units)	$8,720.00	
Less inventory main product (200 units at cost)	1,453.00	
Cost of sales main product		7,267.00
Gross profit		$ 2,733.00
Selling and administrative expenses	$ 500.00	
Less amount allocated to by-product (Schedule 1)	80.00	420.00
Net income		$ 2,313.00

Schedule 1

Net Yield from By-Products		
By-product sales (1,000 units at $.60)		$600.00
Subsequent cost to produce (2,500 units)	$600.00	
By-product inventories (1,500 units at cost, $.24)	360.00	240.00
Gross yield of by-product		$360.00
Selling and administrative expenses		80.00
Net yield of by-product		$280.00

FIGURE 120 Total Costs Less Net Yield from By-Products

The beef-packing industry furnishes the most outstanding example of the use of the net yield on by-products to reduce the cost of the main product. Special interest attaches to by-product accounting in this industry because of the great variety of products resulting from operations and the complexity of the processing. Figure 121 shows the net yield of by-products deducted from main product cost.

The raw material purchased is the live animal; the major product is dressed beef; by-products consist of hides, edible fats, and a variety of other edible and inedible items. By-product credits are arrived at as illustrated in Schedules 1, 2, and 3. Some figures are taken from actual weight or measurement of by-products produced from this particular lot, while other figures are estimated on the basis of normal experience. For example, the so-called "green weight" of hides may be determined by actual weighing as the hides leave the killing floor, but the cured weight which is finally available for sale must be estimated on the basis of the past experience When the calculation has been completed, the net value of all by-product items is combined into one total and deducted from the aggregate expenditure previously recorded. The resultant net cost is allocated to the major product, dressed beef. A further calculation is necessary to convert cost per hundredweight alive into a cost per hundredweight dressed, due allowance being made for the initial yield of dressed beef and for subsequent losses which may take place due to shrinkage and trimming in coolers. This cost ultimately is measured against the selling value of dressed beef, to determine the profit or loss on the operation.

Under the above procedure, profit or loss should appear only in the account for sales of dressed beef, since by-products have been set up on the books at a theoretical net recoverable value. As a matter of fact, the procedure does not lead to the elimination of all profit or loss on by-products, since many computations are estimates and actual experience often is somewhat different. For example, the net amount of each by-product recovered may be somewhat more or less than was estimated; the price at which it is finally sold may be above or below the price used in the cost calculation, and the expense of processing may be greater or less than was anticipated. Thus the by-product accounts typically do contribute some additional profit or loss to the amount figured on the major product.

No. of head, 30. Total live weight, 33,360 lbs. Avg. live weight, 1,112 lbs.
Grade, good steers. Bought from Q. Co. Date, March 27, 19—.

	Weight, Lbs.	Total Cost	Cost per Cwt. Alive
LIVE BASIS:			
Live cattle cost	33,360	$2,135.04	$6.40
Expenses:			
Killing and dressing (at $2.15 per head)		64.50	.19
Cooler (at $.29 per cwt. dressed)		56.30	.17
Total cost and expense		$2,255.84	$6.76
By-product credits:			
Hides, Schedule 1	2,160	$ 121.15	$ .36
Fats, Schedule 2	1,230	42.62	.13
Other items, Schedule 3	2,146	90.35	.27
Total credits	5,536	$ 254.12	$ .76
Net cost		$2,001.72	$6.00
		Cost per Cwt. Dressed	Yield
DRESSED BASIS:			
Cost per cwt. dressed	19,415	$ 10.31	58.2%
Allowance for cooler trim, etc.	155	.08	.5
Total cost of salable beef	19,260	$ 10.39	57.7%

FIGURE 121*a*. Detailed Cost Calculation in Meat-Packing Plant

HIDES

Schedule 1

	No.	Green Weight, Lbs.	Cured Weight, Lbs.	Price per Cwt.	Value
Heavy hides	20	1,456	1,194	$ 8.25	$ 98.51
Heavy hides, branded	5	364	298	6.75	20.12
Light hides	5	340	279	7.25	20.35
	30	2,160	1,771		$138.86
Expense (1,771 lbs. cured weight at $1 per cwt.)					17.71
Net value of hides on killing floor					$121.15

FATS

Schedule 2

Total fats (820 lbs. caul and ruffle fat plus estimated 410 lbs. addl. killing fats = 1,230 lbs. total weight of raw fats)			
Estimated yields			
Oleo oil at 70% of raw fats	861	$ 5.75	$ 49.51
Tallow at 10% of raw fats	123	4.00	4.92
	984		$ 54.43
Expense (984 lbs. rendered weight at $1.20 per cwt.)			$ 11.81
Net value of fats on killing floors			$ 42.62

MISCELLANEOUS BY-PRODUCTS

Schedule 3

Edible items:			
Tongues	228	$11.00	$ 25.08
Livers	326	12.50	40.75
Hearts	116	4.00	4.64
Tails	34	10.00	3.40
Sweetbreads	14	16.00	2.24
Brains	25	5.00	1.25
Head and cheek meat	161	3.00	4.83
	904		$ 82.19
Expense (904 lbs. at $1. per cwt.)			9.04
Net value of edible items			$ 73.15
Inedible items:			
Bones, horns, and hoofs	445	$ 3.00	$ 13.35
Grease	183	2.50	4.58
Tankage	614	1.50	9.21
	1,242		$ 27.14
Expense (1,242 lbs. at $.80 per cwt.)			9.94
Net value of inedible items			$ 17.20
Total miscellaneous by-products			$ 90.35

FIGURE 121*b*. Calculating By-Product Credits

Accounting for Joint Products

Joint Products Defined. Joint products represent two or more products separated in the course of a processing operation usually requiring further processing, each product being in such proportion that no single product can be designated as a major product. In the oil refining industry, gasoline, fuel oil, lubricants, paraffin wax, coal tar, asphalt, and kerosene are all produced from crude petroleum. In the slaughter of hogs, the carcass is cut into hams, ribs, bellies, shoulders, loins, and butts. These are joint products. Where different grades of the same product are obtained, a problem of joint product cost accounting also exists.

Methods of Joint Product Accounting. In joint product accounting joint costs must be prorated and subsequent costs properly charged. Generally speaking, there are four basic methods of accounting for joint product costs up to the split-off point:

1. Average unit cost
2. Apportionment on the basis of some physical unit, such as weight, volume, linear measure, atomic weight, heat units, etc.
3. Apportionment on the basis of the relative market values of the finished products
4. Standard cost method

Average Unit Cost Method. This method is in effect a simplified version of process cost accounting. Only total costs are figured and an average unit cost derived by dividing total production cost by the total number of units of all products yielded. Of course, this method can therefore be used only where the products are expressed in terms of the same units. The average is used for inventory pricing as well as apportionment of joint costs. In the latter case, each product is valued at the average cost in proportion to quantities produced. An example taken from the operations of a sawmill illustrates the method:

1. Total production	2,500,000 ft.
2. Total cost (joint)	$53,000.00
3. Average cost per 1,000 ft., (1) ÷ (2)	$ 21.20

This average is used to cost the various grades produced in proportion to their quantities:

Grades	Quantities Produced (ft.)	Average Cost per 1,000 Ft.	Value of Product
First and second	250,000	$21.20	$ 5,300.00
No. 1 common	1,250,000	21.20	26,500.00
No. 2 common	500,000	21.20	10,600.00
No. 3 common	500,000	21.20	10,600.00
	2,500,000		$53,000.00

The method has been sanctioned by the Bureau of Internal Revenue in the following ruling:

> . . . Tobacco companies taking inventory on the monthly average cost method, no method more nearly approaching theoretical accuracy being possible, may continue to use such method in reporting for income tax . . .

Regulations 111, Section 29.22(c)-7, states:

> A taxpayer engaged in mining or manufacturing who by a single process or uniform series of processes derives a product of two or more kinds, sizes, or grades, the unit cost of which is substantially alike, and who in conformity to a recognized trade practice allocates an amount of cost to each kind, size, or grade of product, which in the aggregate will absorb the total cost of production, may, with the consent of the Commissioner, use such allocated cost as a basis for pricing inventories, provided such allocation bears a reasonable relation to the respective selling values of the different kinds of product.

The last quoted regulation seems to limit the applicability of the average cost method to those cases where the allocated costs bear a reasonable relationship to selling prices. A strict interpretation of the ruling would make it unworkable; unit costs being the same for each joint product, and the selling prices different, the relation of cost to selling price obviously varies from product to product.

The average cost method is not too popular, in spite of its simplicity. It may be used wherever different grades of the same product are turned out by a joint process, though few actually use it.

Allocation of Joint Costs on Physical Unit Basis. Under this method, joint costs are distributed to products on the basis of some physical coefficient, i.e., the joint cost is broken up in proportion to the raw materials contained in each product. The method may be illustrated by reference to the manufacture of coke wherein the costs may be allocated in proportion to the weight of the various products. The weights of all the finished products are determined, per ton of coal, with the exception of gas, which may be found by subtracting the totals of the other products from 2,000. This method is illustrated on page 424; on the assumption that a ton of coal costs $8.

Allocation of Joint Costs on Basis of Selling Prices. The most widely used method of distributing joint costs is on the basis of the relative selling prices of the end products. Under this method each product is charged for whatever the traffic will bear, since the higher the market value, the greater the cost charged against the product. The technique is that of a weighted average, the selling price of each product being multiplied by the quantity yielded to give a total market value of the particular product which is then related to the market value of all products.

SCHEDULE SHOWING APPORTIONMENT OF MATERIAL COST VALUE TO EACH PRODUCT PER TON OF COAL

	Yield in Lbs. of Recovered Products per Ton of Coal	Distribution of Waste to Recovered Products (lbs.)	Revised Weight of Recovered Products	Material Cost (Weight × $.004)
Coke	1,320.0	69.47	1,389.47	$5.56
Coal tar	120.0	6.32	126.32	.50
Benzol	21.9	1.15	23.05	.09
Sulphate of ammonia	26.0	1.37	27.37	.11
Gas	412.1	21.69	433.79	1.74
Waste (water)	100.0			
Total	2,000.0	100.00	2,000 00	$8.00
Cost per pound: $8 ÷ 2,000				$.004

Fluctuations in the market value of any one or more of the end products automatically change the apportionment of the joint costs, though actually it may cost no more to produce than before. As long as fluctuations in prices of the various products are synchronized (not necessarily in the amount, but in the rate of change) their respective costs remain constant. But with some products fairly stable, and others fluctuating, the method breaks down.

Using the same example of lumber mill costs used for the average unit cost proration, the joint cost of $53,000 is distributed to the various grades on the basis of their respective market values as shown in the illustration which follows:

MARKET VALUE METHOD OF JOINT COST APPORTIONMENT

Grades	(1) Quantity Produced (ft.)	(2) Market Value per 1,000 Ft.	(3) Total Market Value	(4) % of Total Market Value	(5) Prorated Cost	(6) Cost per 1,000 Ft.
Firsts and seconds	250,000	$105.00	$ 26,250	17.6471	$ 9,352.96	$37.42
No. 1 common	1,250,000	70.00	87,500	58.8235	31,176.46	24 94
No. 2 common	500,000	40.00	20,000	13.4454	7,126 06	14.26
No. 3 common	500,000	30.00	15,000	10.0840	5,344.52	10.68
	2,500,000		$148,750	100 00	$53,000.00	

The same result may be obtained by eliminating column (4) above and instead obtaining the percent relationship between the joint cost and the total market value. This is shown on page 425:

Grades	(1) Quantity Produced (ft.)	(2) Market Value per 1,000 Ft.	(3) Total Market Value	(4) Prorated Cost (3) × 35.63025%
Firsts and seconds	250,000	$105.00	$ 26,250	$ 9,352.94
No. 1 common	1,250,000	70.00	87,500	31,176.47
No. 2 common	500,000	40.00	20,000	7,126.05
No. 3 common	500,000	30.00	15,000	5,344.54
	2,500,000		$148,750	$53,000.00

Joint Cost Ratio = $53,000 ÷ $148,750 = 35.63025%

A comparison of the gross profit obtained on each grade of lumber shows a rate of approximately 64.37%. This is the outstanding characteristic of the market value method: it stabilizes the gross profit rate by adjusting cost to market value. Under the average cost method the cost is kept constant, but the gross profit is allowed to vary.

The selling price method is also used in distributing costs where different grades of the same product are yielded from a given quantity of raw material. This can be illustrated by reference to the canning industry. Assume in the canning of peas, a quantity of peas has been purchased on contract at a uniform price and that the processing operation is uniform for all grades. The peas after shelling are graded for size, and are canned in lots according to grade. From the total cost and the total estimated sales value, it is possible to develop a cost per can for each grade which is proportionate to the selling price per can currently obtaining for that grade. Again, the effect is to produce a uniform gross margin on the sales of each grade.

STATEMENT OF OPERATIONS FOR ONE MONTH

	Total	Per Cwt.
Cost of peas, contract (43,000 lbs. shelled)	$1,290.00	$ 3.00
Expenses, receiving and handling:		
Receiving stations	627.10	1.46
Trucking to cannery	136.80	.32
Cost of peas at cannery	$2,053.90	$ 4.78
Expenses, canning	2,442.40	5.68
Cost of peas in cans	$4,496.30	$10.46

Distribution of joint cost to grades:

Grade	Production (No. of Cans)	Sales Price per Can	Total Sales Value	Cost Allocated on Selling Price	Cost per Can
1	6,880	$.20	$1,376.00	$1,164.09	$.169
2	13,760	.16	2,201.60	1,862.55	.135
3	12,040	.13	1,565.20	1,324.15	.110
4	1,720	.10	172.00	145.51	.085
Total	34,400		$5,314.80	$4,496.30	

A variation of this method is found in the hog-packing industry (Figure 122). The difference in accounting procedure between beef and hog packing is due to the fact that beef is sold in the form of dressed carcasses which the retailer cuts up, while hog operations result in various products at the packing plant, such as hams, shoulders, etc. Figure 122 shows that the end products are priced on the basis of their current market value. The total values so obtained are subtracted from the total cost consisting of live cost plus expenses of slaughtering. The difference represents cutting profit or loss.

HOG CUTTING TEST—SHORT FORM

Class Butchers Weight Average 220/240 Date July 15, 19—

	Yield %	Per Cwt. Alive	Per Cwt. Dressed
Cost of live hogs		$12.80	
Less value of by-products		.64*	
Net live cost		$12.16	
Yield of dressed carcass	69.5		
Converted live cost . .			$17.50
Plus expense of killing and dressing		.56	.81
Total cost		$12.72	$18.31
Value of cuts (per schedule below)		12.68	18.25
Cutting margin (profit or loss)		—$ .04	—$ .06

Details of Cuts	% of Total Dressed Weight	Price per Lb.	Value per Cwt.
Hams, skinned . .	17.2	$.24	$ 4.13
Picnics	8.0	.20½	1.64
Boston butts	5.8	.25	1.45
Bellies, square-cut	15.8	.17¼	2.73
Fat backs	4.3	.10¾	.46
Loins, blade-in	14.4	.23½	3.38
Spare ribs	2.2	.16¼	.36
Plates and jowls	3.3	.10	.33
Trimmings	4.3	.18	.77
Fats (lard basis)	21.8	.13	2.83
Feet, tails, bones	2.9	.06	.17
Total carcass products	100.0		$18.25

* As per schedule based on standard yields and current market prices.

FIGURE 122. Market Value Method of Joint Cost Apportionment

In other words, the figure of $12.72 represents the joint cost of the various products obtained. But instead of apportioning the joint cost, the meat packer values the products at the market and by comparing the total market value with the joint cost finds a variance representing a so-called cutting profit or loss.

The "converted live cost" in Figure 122 is found by dividing the net live cost ($12.16) by the yield of dressed carcass (69.5%). The same explanation holds for the figures for killing and dressing expense and for total cost. However, for "value of cuts" the dressed value is given by the schedule, and the value "per cwt. alive" is to be found. The latter ($12.68) is obtained by multiplying the total market value ($18.25) by the yield of dressed carcass (69.5%).

Standard Costs as Basis for Distribution

Standard Allowable Costs. Under this cost procedure raw material costs are apportioned to products on the basis of predetermined standards. The cost procedure adopted, to be of a maximum value, must provide management with the following information:

1. A convenient method for determining the price which can be paid for any given lot of raw material
2. Means of measuring actual yields against those anticipated at the time of purchase of the raw material
3. A comparison of actual conversion costs with those anticipated and used in establishing purchase prices

These requirements have been met successfully by the operation of a standard cost system in a company whose activities are confined to the purchase, preparation, and sale of a natural product. A year's supply of raw material is purchased either at public auctions or privately, from many growers spread over a large geographical area. Thus material purchased in any one year varies as to quality, depending upon climatic conditions of the localities from which it is secured. The price paid for each lot is based upon the expected yield of grades as established by test sorting of representative portions before purchase. Material standards are used as a basis for calculating allowable purchase prices. For the purpose of illustration, it is assumed that the following rates have been established:

Purchase expense	$ .50 per cwt.
Freight	1.00
Conversion cost:	
Labor and overhead	3.89
Administrative and distribution cost	20% of sales
Desired profit	10% of sales

Forecast of sales prices:

Grade 1	$200.00
2	100.00
3	50.00
4	30.00
5	20.00
6	10.00

Total work in process, March 1	3,100 lbs. at $12 per cwt.
Total work in process, March 31	2,000 lbs., valued at weighted average price.

With this information and a standard 10% allowance for scrap, the accountant furnishes the purchasing agent with a schedule of prices to be paid for raw materials (Schedule 1):

SCHEDULE OF ALLOWABLE PRICES **Schedule 1**

	Grade					
	1	2	3	4	5	6
Forecast sales price	$200.00	$100.00	$50.00	$30.00	$20.00	$10.00
Less provision for profit, selling, and administrative expenses	60.00	30.00	15.00	9.00	6.00	3.00
Balance	$140.00	$ 70.00	$35.00	$21.00	$14.00	$ 7.00
Available factory cost (10% loss)	126.00	63.00	31.50	18.90	12.60	6.30
Conversion cost and purchase expense	4.00	4.00	4.00	4.00	4.00	4.00
Price f.o.b. factory which can be paid for raw material	$122.00	$ 59.00	$27.50	$14.90	$ 8.60	$ 2.30

The last line in the above table shows the maximum price that could be paid for a lot if it tested 100% grade 1 or 100% grade 2, etc. Assuming a given lot tests as shown in Figure 123, the maximum price per cwt., f.o.b. factory, is $12.69, which becomes standard for the lot.

The cost accountant receives a report of each lot purchased. Quantities on the report are priced at the standard price per hundredweight. A summary is then prepared of the standard values of all lots, and the total is adjusted for expected scrap loss. The total standard cost of $511,500 is then allocated to grades as shown in Schedule 2:

STANDARD VALUES BY GRADES **Schedule 2**

Grade	Expected Yield in Pounds	Forecast Sales Price per Cwt.	Forecast Sales Values	Prorated Standard Material Cost	Material Cost per Cwt.
1	100,000	$200.00	$200,000.00	$110,000.00	$110.00
2	200,000	100.00	200,000.00	110,000.00	55.00
3	400,000	50.00	200,000.00	110,000.00	27.50
4	500,000	30.00	150,000.00	82,500.00	16.50
5	500,000	20.00	100,000.00	55,000.00	11.00
6	800,000	10.00	80,000.00	44,000.00	5.50
	2,500,000	$ 37.20	$930,000.00*	$511,500.00*	$ 20.46

* $511,500 ÷ $930,000 = 55%.

Since the total actual material cost is 55% of the forecasted sales price, the joint material cost is distributed to the various grades by taking 55% of the expected sales price for each grade. Conversion costs (labor and overhead) are calculated at a uniform figure per hundredweight for all grades. This yields costs for the different grades as shown in Schedule 3:

COSTS APPORTIONED TO GRADES **Schedule 3**

Grade	Material Cost	Conversion Cost (Labor and Overhead)	Total Factory Cost	Selling and Administrative Expense	Total Cost
1	$110.00	$3.89	$113.89	$40.00	$153.89
2	55.00	3.89	58.89	20.00	78.89
3	27.50	3.89	31.39	10.00	41.39
4	16.50	3.89	20.39	6.00	26.39
5	11.00	3.89	14.89	4.00	18.89
6	5.50	3.89	9.39	2.00	11.39

With all standards set, the accountant is prepared to measure actual against expected yields for material, as well as for conversion costs. The latter are handled in the same way as in any other industry. The basis of material accounting is the inventory ledger card (Figure 123), a separate card being prepared for each lot. The card shows the expected yield, the actual cost including standard buying expense and transportation charge, consumption of material, and inventory data. It furnishes the basic data for subsequent analysis.

From the inventory cards, material consumption (usage) is summarized by lots at the end of each cost period. The difference between the total actual and total standard values represents a price variance the responsibility for which falls on the purchasing department. Schedule 4 shows such a summary and reveals an unfavorable price variance of $61 (i.e., $3,488.20 — $3,427.20).

SUMMARY OF USAGES **Schedule 4**

Lot	Pounds	Actual Cost	Standard Rate	Standard Cost
14-891J	1,100*	$ 126.50*	$12.69*	$ 139.59
17-101	5,000	600.00	11.58	579.00
22-236B	1,400	140.00	10.40	145.60
22-236D	10,800	1,350.00	12.10	1,306.80
30-111	6,400	921.60	14.00	896.00
30-112A	1,100	141.90	13.11	144.21
30-112B	1,500	208.20	14.40	216.00
	27,300	$3,488.20	$12.55	$3,427.20

* From Figure 123.

Lot Number: 14-891 J	Date Purchased: 10/14/—
Purchased from: Brown and Grower, Middleburg	Date Received: 11/2/—

Expected Yield: Grade	Per Cent	Pounds	Standard Rate per Cwt.	Standard Cost
1	2	200	$122.00	$ 244.00
2	3	300	59.00	177.00
3	10	1,000	27.50	275.00
4	15	1,500	14.90	223.50
5	30	3,000	8.00	258.00
6	40	4,000	2.30	92.00
	100	10,000	$ 12.69	$1,269.50
Cost:				
Purchase price		10,000	$ 10.00	$1,000.00
Purchase expense			.50	50.00
Freight			1.00	100.00
			$ 11 50	$1,150.00

Usage			Inventory		
Date	Pounds	Cost (Actual)	Date	Pounds	Cost (Actual)
19—			19—		
Mar. 3	500		Jan. 1	10,000	$1,150.00
11	400	$ 126.50			
27	200				
31	Bal. 8,900	1,023.50			
	10,000	$1,150.00		10,000	$1,150.00

FIGURE 123. Inventory Ledger Card

Material Yield and Scrap Variances. The Stores account, in this instance, is debited and credited at *actual* cost. Credits to Work in Process for scrap and closing inventory are at a weighted average price, as shown in Schedule 5:

SCHEDULE OF MATERIAL CONSUMPTION Schedule 5

	Quantity Lbs.	Unit Standard Value	Total Value
Inventory of Work in Process, March 1	3,100	$12.00	$ 372.00
March charges (Schedule 4) . . .	27,300	12.55	3,427.20
Total charges to Work in Process	30,400	$12.50	$3,799.20
Less inventory of Work in Process, March 31	2,000	12.50	250.00
March consumption .	28,400		$3,549.20

The reported production for March was as follows:

Grade	Quantity (lbs.)	Standard Rate	Material Values
1	540	$110.00	$ 594.00
2	1,220	55.00	671.00
3	2,420	27.50	665.50
4	4,460	16.50	735.90
5	7,240	11.00	796.40
6	10,120	5.50	556.60
	26,000	$ 15.46	$4,019.40

A scrap variance can now be calculated. Actual scrap is 2,400 pounds (i.e., 28,400 – 26,000) which is transferred from Work in Process, to a Scrap Variance account at the weighted average price. The latter account is credited for the standard scrap allowance (10% of 28,400 pounds), the balance representing in this case a gain or favorable variance, since less than standard allowed scrap was produced (Figure 124).

The complete journal entries giving rise to the accounts in Figure 124 are as follows:

JOURNAL ENTRIES

(1)

Stores	$3,488.20	
Accounts Payable		$3,488.20

To record purchase of 27,300 pounds at actual cost. (Schedule 4.)

(2)

Work in Process	$3,427.20	
Material Price Variance	61.00	
Stores		$3,488.20

To record stores issues at actual and charge production at standard cost. (Schedule 4.)

(3)

Scrap Variance	$ 300.00	
Work in Process		$ 300.00

To transfer actual scrap out of work in process at weighted average cost (2,400 lbs. at $12.50 per cwt.).

(4)

Finished Goods	$4,019.40	
Work in Process		$4,019.40

To transfer completed production at standard rates for grades produced. (Schedule 5.)

(5)

Work in Process (New)	$ 250.00	
Work in Process (Old)		$ 250.00

To establish inventory of 2,000 lbs. at weighted average price of $12.50 per cwt.

STORES

		Quantity in Lbs.	Rate	Amount			Quantity in Lbs.	Rate	Amount
Actual cost .	(1)	27,300		$3,488.20	March usage (actual) .	(2)	27,300		$3,488.20

WORK IN PROCESS

3/1 Balance		3,100	$12.00	$ 372 00	March consumption:				
March usage	(2)	27,300	12.55	3,427.20	Scrap variance	(3)	2,400	$12.50	$ 300.00
Total variance	(6)			770.20	Transfer .	(4)	26,000		4,019.40
					3/31 Inventory	(5)	2,000	12.50	250.00
		30,400		$4,569.40			30,400		$4,569.40
4/1 Balance	(5)	2,000	12.50	$ 250.00					

FINISHED GOODS

Standard production	(4)	$4,019.40	

MATERIAL PRICE VARIANCE

Loss ($3,488.20 — $3,427.20)	(2)	$ 61.00	

TOTAL VARIANCE

Scrap variance	(7)	$ 355.00	Work in process . . .	(6)	$ 770.20
Yield variance	(8)	415.20			
		$ 770.20			$ 770.20

SCRAP VARIANCE

Actual scrap	(3)	2,400	$12.50	$ 300 00	Standard scrap allowance . .	(7)	2,840	$12.50	$ 355.00
Gain on scrap				55.00					
				$ 355.00					$ 355.00

YIELD VARIANCE

			$ 415.20

FIGURE 124. Standard Cost Accounts in Joint Costs

(6)

Work in Process (Old)	$ 770.20	
Total Variance		$ 770.20

To close balance in former account.

(7)

Total Variance	$ 355.00	
Scrap Variance		$ 355.00

To credit the latter account for standard scrap allowance at weighted average price:
10% of 28,400 pounds = 2,840 lbs.
28.40 × $12.50 = $355.00

(8)

Total Variance	$ 415.20	
Yield Variance		$ 415.20

To close balance in former account.

QUESTIONS

1. The costing of manufacturing overhead to a product or process involves the problem of accounting for joint costs. Explain.
2. Explain four methods of accounting for by-products.
3. The cost of the main product or products is dependent upon the market price of the by-product and thus becomes a cost controllable only in part by management. Explain by reference to methods described in Question 2.
4. What is meant by the term "split-off point" and why is it significant in the accounting for by-products and joint products?
5. Explain the use of standard allowable costs as a means for predetermining the prices which should be paid for raw materials.
6. Fuel oil derived as a joint product from petroleum competes with coal for use in heating homes. Gasoline is also a joint product of petroleum. Assuming that as a result of price wars the retail and wholesale prices of gasoline are materially reduced, how would this affect the cost of fuel oil? If the selling price of fuel is set by reference to its cost, how could the competitive position of coal be affected?
7. What is the basic difference involved in accounting for by-products and for joint products?
8. A company buys soybeans from country elevators to produce soybean oil meal and soybean oil. The beans are cracked, dried to approximately 3% moisture, then run through an expeller which squeezes out the oil leaving a residue in the form of a cake. The cake is ground into meal to which moisture is added bringing it up to about 12% moisture content. A bushel of beans (60 pounds) produces about 9 pounds of oil (15%) and about 49 pounds of meal (82%) leaving a 3% shrink. During the current season the average cost of beans was about $3.00 per bushel and processing costs about $0.23 per bushel. The sale price

of oil was $.25 per pound and meal $75.00 per ton. What is the cost of oil and of meal?

9. Your client, a furniture manufacturer, recently organized a department to make toys, utilizing therefor short lengths of expensive hardwoods, which were formerly disposed of as waste. In order to settle a dispute between your client's chief accountant and the manager of the toy department, who feels that his department should be charged nothing for this kind of material, you are requested to recommend a method of determining the amount, if any, at which the short lengths should be transferred from the furniture department to the toy department and to explain the reasons for your recommendation. Draft the body of a letter to comply with this request.

10. The management of a company requests your advice as to the accounting treatment for by-products expected to be produced as a result of the manufacture of a new principal product. You are requested to explain various methods of accounting for by-products and the circumstances influencing the selection of each method.

11. When basic raw materials are processed by a series of operations, how should the cost of manufacture be allocated to the various products and by-products—
    a) Where one principal commodity is produced in several classes and grades, leaving by-products that are sold without further processing?
    b) Where two principal commodities are produced in diverse classes and grades after the raw material has passed through several intermediate processes, and in the successive stages of manufacture various by-products are recovered that are sold without further processing?

Chapter 22

BUDGETS

Definitions and Objectives. A budget is a plan for coordinating the various operations of a business expressed in financial terms. It is primarily a blueprint of a projected plan of action of a business for a definite period of time. In recent years the phrase "budgetary control" has come into extensive use. It includes all the objectives which a business hopes to realize through the introduction of a complete budget. These include an adequate return on the investment, planning and forecasting, coordination, and control. Basically the main objective of a business is to earn a satisfactory return on its investment after paying for services and commodities which it buys. Hence the budget must comprise plans to produce and sell a sufficient quantity of merchandise at costs and prices which will yield a desired profit. Good management requires that such operations be planned and coordinated rather than left to chance.

Planning and forecasting, reduced to their simplest terms, imply that each department of the business sets its objectives for the coming period and makes plans for accomplishing them. It also involves the formulation of policies regarding what is to be sold, where, and how. Detailed plans of future courses of action must be set forth and since these are likely to be affected by external influences, some attempt should be made to evaluate them and reflect them in the budget. If the original plans are not satisfactory, they will have to be revised.

Coordination involves the operation of a business as a unified whole rather than as a group of separate departments. Since departments are only segments of a business, plans for individual departments must be coordinated in such a way that the objectives of the company as a whole will be achieved.

Control implies the attainment of desired objectives through the measurement of results, especially through comparative reports. The latter involve comparison of actual and forecasted revenues, costs, expenses, and profits, and particularly placing responsibility for failure to achieve the objectives.

Relationship Between Budgeting and Accounting. Preparing and operating the budget involves all segments of the company and hence budgeting is not purely an accounting function. However, on the accounting department falls the duty of assembling the data and translating them into financial terms. This process has been described as accounting for events before they happen as well as afterwards. In a sense, this is an accurate conception since the accounting department determines what the company's income statement and balance sheet will look like at the end of a coming period if the plans made are realized. While some companies have a separate budget department to do this work, it must be closely related to the accounting department and much of the budget department's work is of an accounting nature.

Relationship Between Budget and Standard Costs. Budgeting is a much broader term than standard costs. Budgeting comprises the setting of objectives for all aspects of income and expense for all departments of the business, whereas standard costs include only operating costs. In reality, standard costs are but one aspect of a completely developed budget in which all phases of a company's operations have been planned and the financial results predetermined. Such a complete budget is composed of individual budgets for each subdivision of the company. In setting these individual budgets, standards are employed to determine how much the planned activities ought to cost and forecasts are made to determine what sales income may be expected.

Administration of Budget. Whether a budget is to be administered by a budget director, a budget committee, or both depends in part on the size of the business and the preference of the chief executive. In any event it must be understood that responsibility for the budget rests with the chief executive, even if he delegates some of the functions to others, since he alone has jurisdiction over all phases of activity of the business. If a budget director is appointed, he assists in the collection, analysis, and interpretation of information of past results. He prepares and enforces the budgetary procedure in the form of a budget manual. The latter acts as a guide in the introduction and maintenance of a budget program by defining the duties of each individual and setting forth the manner and form of preparation of the budget estimates. The budget director also receives reports showing comparison of actual and estimated costs to which he may add his interpretations and recommendations. Finally he acts as liaison between the department heads and the budget committee or the chief executive.

The budget committee may take the budget director's place in smaller companies. In large companies it reviews the budget director's estimates and recommends revisions. It may also recommend specific action during the budget year whenever, in its opinion, such action seems warranted. When functioning in this way, the budget committee becomes in fact a management committee and is a powerful force in knitting together the various activities of business, and enforcing real control of operations.

Length of Budget Period. Many companies find it desirable to have a long-range budget setting forth their major objectives for a period from three to five years or more. Such a budget may then provide the framework into which the budget for a specific fiscal year must fit. It is usually also found necessary to break down the annual budget into shorter fiscal periods ranging from a week, a month, or a quarter of a year. Such short-term budgets are useful in providing yardsticks for measuring the degree of accomplishment toward the total result desired. Some companies use a combination long- and short-term budget, keeping their estimates always a certain period in advance of the current period by adding a new month, quarter, or year, as the case may be, to their forecast as each period is completed.

Budgeting Procedure. Business budgeting ordinarily consists of the following steps:

1. Making a sales forecast which largely determines how much is to be spent for selling and what quantity of goods must be made available. The result is a sales budget and a selling expense budget.
2. Preparing a production budget which comprises planning needs for material, labor, and manufacturing facilities, together with the costs of these items.
3. Preparing a plan to meet financial needs of the business, including cash for payrolls, creditors, dividends, capital additions, etc. This includes the cash budget and the capital expenditure budget.
4. Assembling and coordinating individual budgets into a master budget. At this stage a budgeted income statement and balance sheet for the company as a whole are prepared.
5. Reporting current performance and comparing it with the budget. Management is kept informed of progress relative to the budget by these reports.

Sales Budget

Sales the Starting Point. The quantity of goods to be sold and the amount of income to be derived from sales constitutes the starting point in budgeting. Hence the sales budget is prepared before production and financial budgets because the latter depend largely upon the sales budget. Sales cannot be planned at will, for volume, variety, and prices are all subject to willingness and ability of customers to buy, although these can be influenced by advertising and by selling and distribution methods used. Hence it is necessary to forecast what sales will be.

Forecasting Sales. A sales forecast is a statement of what sales are expected in a future period. As prepared for budgeting purposes, it usually gives the following detailed information:

1. Sales by products. This is the basis for planning the amount of each product to be produced. Sales should be expressed in units as well as in dollars.
2. Sales by territories. By forecasting the sales in each territory it is possible to allow for variations in accordance with local conditions and to set goals for each territorial sales manager.
3. Sales by type of customer. Goods sold to different types of customers may carry different profit margins and this forecast is needed to forecast profits and cash receipts.
4. Sales by months. Distribution of sales during the year helps in planning production, especially where finished goods stocks are built up in months of slack sales and sold in months of heavy sales.

Figure 125 illustrates a sales budget prepared to show anticipated sales by territories and by products. In preparing the schedule, blank columns have been left in which to insert actual sales figures when the latter become known. In forecasting sales it is necessary to study past sales experience, to survey current and expected business conditions, and to give effect to any change in conditions within the company itself.

Analysis of Past Sales. Sales figures from past periods are obtained from company records and analyzed to determine any tendencies which may affect sales of the coming period. Ordinarily it is possible to discern the following fluctuations:

1. Long time trend, or a more or less steady tendency to grow or to decline over several years. Usually the same rate of growth or decline is expected to continue in the coming budget period.
2. Cyclical fluctuations, or swings from a high to a low rate of business activity and back again over a period of several years. Such cycles are seldom regular in timing or amplitude, but it may be of help to know what the pattern of fluctuation has been.
3. Seasonal variations. Many companies experience regular and recurrent seasonality in their sales and can plan production and sales promotion to meet demands of customers at the right time.
4. Irregular fluctuations due to wars, strikes, and other random events.

Sales figures from previous periods must be converted to the current price level if the figures are dollar figures. Figures expressed in quantities are not affected by changes in price and therefore need not be ad-

Sources of data:
Market Research Reports and
Field Estimates
Prepared by· F. L. Harvey
Checked by: H. E. Howell 11/1/—

BUDGET OF ANTICIPATED SALES FOR FIRST HALF 19—

By Territory—By Product

	Product	January Estimate	Actual	February Estimate	Actual	March Estimate	Actual	April Estimate	Actual	May Estimate	Actual	June Estimate	Actual	Total First 6 Months Estimate	Actual
EASTERN TERRITORY		$		$		$		$		$		$		$	
	A	700		616		684		640		676		684		4,000	
	B	1.750		1,540		1,710		1,600		1,690		1,710		10,000	
	C	175		154		171		160		169		171		1,000	
	D	700		616		684		640		676		684		4,000	
	E	7,000		6,160		6,840		6,400		6,760		6,840		40,000	
	F	350		308		342		320		338		342		2,000	
	G	350		308		342		320		338		342		2,000	
	H	350		308		342		320		338		342		2,000	
	J	525		462		513		480		507		513		3,000	
	K	875		770		855		800		845		855		5,000	
	Total Sales	12.775		11.242		12,483		11,680		12,337		12,483		73,000	
	%	17 5%		15 4%		17.1%		16 0%		16 9%		17.1%		100%	
SOUTHERN TERRITORY	A	4,375		3,850		4,275		4,000		4,225		4,275		25,000	
	B	5.250		4,620		5,130		4,800		5,070		5,130		30,000	
	C	210		185		205		192		203		205		1,200	
	D	525		462		513		480		507		513		3,000	
	E	5,600		4,928		5,472		5,120		5,408		5,472		32,000	
	Total All Customers	39,778		35,003		38,868		36,368		38,416		38,867		227,300	

Figure 125. Sales Budget

justed. Adjustment of dollar figures is made either by extending the quantities for all periods at current prices or by multiplying the dollar figures by index numbers which represent changes in prices of the company's products. The method is illustrated in Figures 126a and 126b.

Year	Quantity	Unit Price	Total Sales	Total Sales in Year 6 Prices*	Index of Prices (Year 1 as base)	Sales Deflated Through Use of Index of Prices**
1	3,700	$2.00	$ 7,400.00	$ 9,250.00	100	$ 7,400.00
2	4,600	2.25	10,350.00	11,500.00	112.5	9,200.00
3	5,300	2.20	11,660.00	13,250.00	110	10,600.00
4	6,500	2.30	14,950.00	16,250.00	115	13,000.00
5	8,200	2.35	19,270.00	20,500.00	117.5	16,400.00

* Year 6 price estimated at $2.50 each.

** The same results could be achieved by multiplying quantities by base year price ($2.00). In most cases such information is not available and accordingly the index number method is used.

FIGURE 126*a*. Methods for Adjusting Sales Figures to a Given Price Level

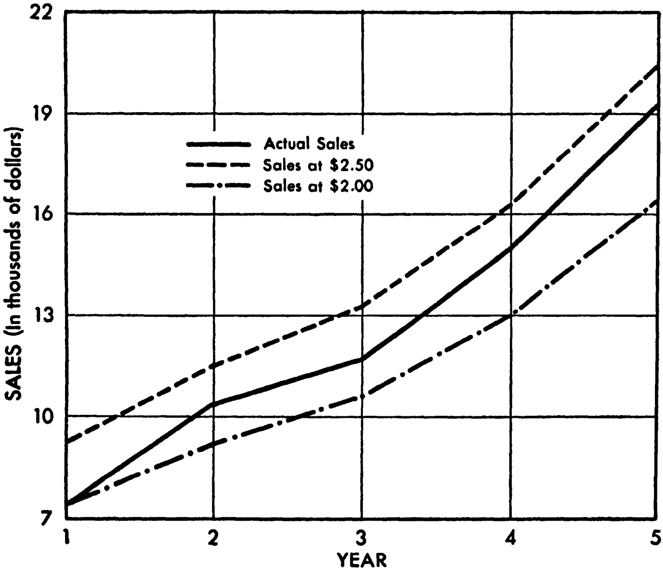

FIGURE 126*b*. Adjustment of Sales Figures to a Given Price Level

Past experience is only a guide to the future and full consideration must be given to factors which may cause future sales to differ from those in the past. Some of these are within the company itself and are known, although their effect on sales may be difficult to estimate. For example, an increase in the amount spent for advertising or addition of new sales territories can be expected to increase sales in comparison with past periods. Other factors, such as purchasing power of customers, actions of competitors, and general business conditions may be studied and their probable effect on company sales estimated. Reports from salesmen often can be used to good advantage in determining what customers are likely to buy and how much.

Sales forecasts cannot be exact, but when based upon careful analysis of all available information they are much better than an uninformed guess. In any event plans must be predicated upon some expectation of sales volume.

The margin of error in a forecast generally increases with the length of the period covered by the forecast. Hence most companies review and revise their forecasts at intervals during the budget period. A commonly used plan is to prepare a new sales forecast each quarter, making the forecast for a year ahead in each case. By this method the previously made forecast is revised and the forecast extended for an additional three months. Thus the sales forecast is always reasonably current.

It must be understood that preparation of the sales budget involves statistical techniques ranging from the fairly simple to the highly complex.[1] This is especially true in correlating the forecast with general business conditions and also forecasting the percentage of the total industry business the company in question may reasonably expect in the light of its past experience and the long-term trend exhibited by the company's sales figures. If a budget is adopted in excess of the regular percentage of industry total, it should be supported by special sales promotion plans.

In arriving at a forecasted sales volume it is customary to start with sales potentials in the various territories in which the company is active. These potentials rest on careful market studies and point particularly to the type of market the company is aiming at: whether it is a consumer market, an industrial market, or farm market. Such studies may well be bolstered by estimates from the field furnished by district managers, salesmen, and others. Finally the estimates may be modified by a knowledge of competing, complementary, and feeder industries, and the purchasing power index analyzed by states, counties, and cities.

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[1] For actual methods of analyzing time series such as are involved in sales forecasting, see any standard textbook in elementary statistics. Cf. Theodore Lang (Ed.) *Cost Accountants' Handbook* (New York: The Ronald Press Co., 1944), pp. 1238-53.

Production Budget

The production budget has two aspects, namely, the budget for the quantity of goods to be produced and the budget for cost of goods produced. The quantity budget serves as a basis for plant capacity studies, for production planning, and for estimating requirements for materials, labor, and other production facilities. The cost of production budget ties production plans in with the budgeted profit and loss statement, budgeted balance sheet, and the cash budget.

Plant Productive Capacity. Before the production budget is definitely established, the quantity to be produced should be compared with the production capacity of the plant. This must be done department by department, since the variety of products called for by the sales forecast may exceed the ability to produce in some departments while leaving unused capacity in others. For example, a company manufacturing office machines can produce an ample supply of component parts; if necessary, it can obtain more by subcontracting for production of such parts by other companies or by expanding its own plant facilities. On the other hand, its assembly department requires highly skilled employees and the number cannot be quickly increased because of the long training period required. The capacity of the assembly department thus definitely limits the production capacity of the company. Furthermore, since the larger machines require more hours to assemble than do smaller machines, fewer of the larger machines can be made. It is evident, therefore, that productive capacity may become a limiting factor.

Production Planning. Production planning includes a determination of the products to be manufactured, the volume in which they are to be produced, and a timetable of production. It also involves determination of the quantities of material, labor, and equipment that will be needed. The nature of the product and the processes of production affect the extent to which budgetary plans can be made in detail. If production is for stock, sales, production, and inventories must be carefully balanced. A product made for stock by comparatively simple processes offers few difficulties since requirements for material and labor are definitely known. Here the sales budget is readily translated into the number of units to be produced. If, for example, 100 units are in finished goods inventory at the beginning of the period, if sales forecasted are 1,000 units, and if management wishes to have a closing inventory of 80 units, then 980 units must be produced. Usually inventories must be broken down into work in process and finished goods when making such calculations. Figure 127 shows a summary of budgeted production and purchases.

Sources of data Sales Budget
Inventory Control
Prepared by: F. L. Harvey
Checked by: H. E. Howell 11/3/—

STATEMENT OF INVENTORY DEMANDS AND REQUIRED PRODUCTION AND PURCHASES

Period: First Six Months 19—

Product	Inventory 12/31/—	Estimated Demand January (Cost of Sales)	‡ Desired Inven. 1/31/—	† Purchases or Prod. Required January	Est. Demand February	Desired Inven. 2/28/—	Purchases or Prod. Required February	Est. Demand March	Desired Inven. 3/31/—	Purchases or Prod. Required March	Total First 6 Months	
											Estimated Demand	Purchases or Prod. Required
	$	$	$	$	$	$	$	$	$	$	$	$
A . .	24,000	4,327	23,106	3,433	3,700	22,840	3,434	4,173	22,100	3,433	24,400	20,600
B .	58,000	9,902	55,528	7,430	8,713	54,245	7,430	9,675	52,000	7,430	56,580	44,580
C .	2,100	350	2,017	267	308	1,975	266	342	1,900	267	2,000	1,600
D .	6,500	1,022	6,185	707	899	5,993	707	998	5,701	706	5,840	4,240
E	76,000	12,054	72,093	8,147	10,608	69,631	8,146	11,778	66,000	8,147	68,880	48,880
F	3,200	550	3,057	407	485	2,979	407	538	2,849	408	3,145	2,445
‡ Total Our Mfr.	169,800	28,205	161,986	20,391	24,713	157,663	20,390	27,504	150,550	20,391	160,845	122,345
G .	5,100	847	5,593	1,340	745	5,848	1,000	828	5,020	.	4,840	3,340
H .	7,300	1,184	7,780	1,664	1,040	7,740	1,000	1,157	6,583	. .	6,764	4,664
J	10,800	1,725	11,931	2,856	1,518	11,413	1,000	1,685	9,728	..	9,856	6,856
K	5,900	945	6,555	1,600	832	5,723		923	4,800	...	5,400	3,600
† Total Purchased .	29,100	4,701	31,859	7,460	4,135	30,724	3,000	4,593	26,131	.	26,860	18,460
Total Mfd. & Purchd.	198,900	32,906	193,845	27,851	28,848	138,387	23,390	32,097	176,681	20,391	187,705	140,805
‡ Raw Matl. for Mfr.	30,000	14,117	30,000	14,117	14,117	30,000	14,117	14,117	30,000	14,117	84,702	84,702
.	228,900		223,845			218,387			206,681			.

† Products G, H, J, K purchased for resale in same form.

It will be noted that the inventory is allowed to fluctuate during the period in order to maintain constant production over the period. To do this, an arbitrary inventory at the end of the period is set and the total estimated demand for the period inserted and the total production required is then figured and divided by 6 to get the monthly production, which is then inserted under the proper month. Purchases can be estimated to fall in those months when other expenditures are not excessive. Another set of conditions may be worked on this schedule such as building up inventory, planning shutdowns, etc.

‡ The monthly desired inventory will be obtained by taking the inventory first of month, deducting demand and adding production or purchases as figured.

Figure 127. Summary of Budgeted Production and Purchases

Where a complex product requiring many parts, assemblies, and different operations is produced, separate production schedules must be prepared for each part and the whole coordinated so that adequate quantities of each item will be available when and where needed. In a business where all products are made to order it is impossible to forecast what will be made. Large and complicated items are usually ordered well in advance and the company may have a backlog of orders covering the immediate future at least. In other cases it is possible to translate the sales forecast into man or machine hours and to budget factory production in such terms.

Where maintenance of minimum inventories is the agreed upon policy, it is essential to have a proper balance of each type of product in the inventory at all times. Accordingly, a calculation of planned production is made for each product or line of products individually, and the results combined to give a total production forecast:

	January	February	March
Forecasted sales (in units)	80,000	120,000	150,000
Add desired inventory, end of month	100,000	130,000	110,000
Total	180,000	250,000	260,000
Less inventory, beginning of month	70,000	100,000	130,000
Scheduled production	110,000	150,000	130,000

An example of how a shoe company correlates production with sales forecasts is shown in Figure 128. This company assumes it must have on hand on the first of each month an inventory equal to one and one half times the sales expected that month. Thus to determine the production for the month of January, proceed as follows:

Required stock, first of February (equal to 1½ times February sales)	11,200
Sales for January	5,600
Total	16,800
Required stock, January 1	8,400
Required production for January	8,400

The role that inventories play in production planning is therefore evident. By keeping inventories at a minimum, a maximum turnover is obtained. In addition there are savings in insurance, storage and handling costs, property taxes, spoilage, and obsolescence.

The production budget must be modified to give consideration to changes in the volume of work in process at the end of each month. Where the policy is to keep the finished goods inventory at a minimum and related to sales demand, an increase in sales must be anticipated by increasing the work in process. The average length of the production cycle indicates how far in advance of an increase in sales the increase in production must be planned. Similarly, a reduction of work in process must precede a forecasted drop in sales. It should be noted that production must be accelerated faster than sales on the upturn, and decelerated faster than the decline in sales on the down grade, if the policy of keeping inventories in direct relation to sales is followed. This is true because an increase in sales requires added production both to meet the increased sales and also to keep the inventory in the desired relation to sales. This is one of the undesirable features of attempting to maintain a fixed rate of inventory turnover for all rates of sales activity.

PRODUCTION BUDGET

STOCK SHOES—REQUIRED PRODUCTION FOR STOCK

JANUARY-JUNE, 19—

	Month	(1) Expected Shipments	(2) Required Stock 1st of Month	(3) Change in Stock During Month	(4) Required Production During Month
GRADE A	January	5,600	8,400	2,800	8,400
	February	7,500	11,200	5,300	12,800
	March	11,000	16,500	2,600*	8,400
	April	9,300	13,900	2,700*	6,600
	May	7,500	11,200	2,000*	5,500
	June	6,100	9,200	0	6,100
GRADE B	January	8,500	12,800	4,200	12,700
	February	11,300	17,000	7,200	18,500
	March	16,100	24,200	3,000*	13,100
	April	14,100	21,200	4,200*	9,900
	May	11,300	17,000	3,200*	8,100
	June	9,200	13,800	0	9,200

* Red.

Explanation:

Column 2. One and one-half times column (1)—stock in pairs required to cover fluctuations in orders from customers by styles, widths, and sizes.

Column 3. Additions to or subtractions from production required to meet shipments to correct basic stock on first of following month.

Column 4. Sum of columns (1) and (3).

FIGURE 128. Production Budget in Relation to Required Stock

As against this possibility there is the problem of stabilizing production which may increase inventories at certain times of the year beyond what is immediately necessary. On the other hand stabilized production brings with it such benefits as reduced costs of labor turnover, hiring, and training, as well as improved morale. There may also be savings in state unemployment insurance taxes under merit rating provisions, and reduced overtime premiums because of more even work spread. Finally, less productive capacity may be required, thus bringing about a saving in fixed charges, and production can be planned to take advantage of most economical size production runs. The decision as to the proper course depends on many factors, such as available working capital, available productive capacity, whether the product is a staple or subject to style changes, the proportion of skilled to unskilled labor and the availability of each type, extent of price fluctuations in raw materials and finished goods, and setup costs.

Cost of Production. The budgeted cost of production is determined by extending the number of units to be produced by the standard cost of each product. It may be necessary to budget variances from standard cost, since it may be expected that variances will arise because efficiency will be below standard or volume less than standard capacity. Figure 129 shows a statement of budgeted cost of production for a company which uses standard costs.

Budgeting Cost of Goods Sold. Budgeting is facilitated by the use of standard costs. Where standard costs are in use, the production cost standards are revised when preparation of the budget begins. In this way changes which have occurred in production methods, prices of cost factors, and any other items affecting the standards are incorporated in the standard costs. These can then be used to determine budgeted cost of goods sold by simply multiplying budgeted quantities of each product by the standard cost of that product. Figure 130 illustrates a statement of budgeted cost of sales. The budgeted selling price of the goods has been included in the statement to make possible a quick appraisal of the relative gross margins.

If standard costs are not in use, actual costs from past periods can be used to estimate probable cost of sales. The method is illustrated below:

	Percentage of Sales*	Budget for Next Period
Net Sales	100%	$100,000.00
Estimated Cost of Sales:		
Direct Material	15	$ 15,000.00
Direct Labor	25	25,000.00
Overhead	20	20,000.00
Cost of Sales	60%	$ 60,000.00

* Based on past experience.

Sources of data:
Standard Cost System
Capacity Variance Data
Prepared by: F. L. Harvey
Checked by: H. E. Howell 11/2/—

STATEMENT OF COST OF PRODUCTION

Product	January						Total First Six Months				
	Mfg. Div. Std. Invy. Price	Std. Cost Raw Mtl.*	Std. Cost Lbr.	Std. Over-head	Est. Variation from Std. (−) Excess Cost (+) Cost below Std.	Feb. Mar. April May June	Mfg. Div. Std. Invy. Price	Std. Cost Raw Mtl.	Std. Cost Lbr.	Std. Over-head	Est. Variation from Std. Profit (−) Excess Cost (+) Cost below Std.
	$	$	$	$	$	Figures not repeated as they are same as for January due to planning equal production each month per schedule of Inventory demands.	$	$	$	$	$
A .	3,433	2,060	1,030	343	+ 46		20,600	12,360	6,182	2,058	+ 276
B . . .	7,430	5,573	1,485	372	− 106		44,580	33,437	8,911	2,232	− 636
C . .	267	133	94	40	− 4		1,600	800	560	240	− 24
D .	707	424	212	71	.		4,240	2,544	1,270	426	.
E . .	8,147	5,703	1,629	815	− 38		48,880	34,216	9,774	4,890	− 228
F .	407	224	122	61	− 5		2,445	1,345	734	366	− 30
Totals .	20,391	14,117	4,572	1,702	− 107		122,345	84,702	27,431	10,212	− 642

* If own foundry is operated to manufacture the raw material this column will be broken in subschedule to show Standard Foundry Labor, Material and Expense and Variance.

Figure 129. Budgeted Cost of Production

Sources of data:
Sales Budget
Inventory Control
Standard Cost Record
Prepared by: F. L. Harvey
Checked by: H. E. Howell 11/1/—

STATEMENT OF STANDARD COST OF SALES

Period: First Six Months 19—

Product	January		February		March		Total Selling Price	First 6 Months Standard Cost of Goods Sold
	Selling Price	Standard Cost of Goods Sold	Selling Price	Standard Cost of Goods Sold	Selling Price	Standard Cost of Goods Sold		
	$	$	$	$	$	$	$	$
A	5,337	4,327	4,697	3,700	5,216	4,173	30,500	24,400
B	12,075	9,902	10,626	8,713	11,799	9,675	69,000	56,580
C	438	350	385	308	427	342	2,500	2,000
D	1,278	1,022	1,124	899	1.248	998	7,300	5,840
E	14.700	12,054	12,936	10,608	14,364	11,778	84,000	68,880
F	647	550	570	485	633	538	3,700	3,145
Total Our Mfr.	34,475	28,205	30,338	24,713	33.687	27,504	197,000	160,845
G	962	847	847	745	940	828	5,500	4,840
H	1,331	1,184	1.169	1,040	1,300	1,157	7,600	6,764
J	1,960	1,725	1,725	1,518	1,915	1,685	11,200	9,856
K	1,050	945	924	832	1,026	923	6,000	5,400
Total Purchased	5,303	4,701	4,665	4,135	5,181	4,593	30,300	26,860
Total Mfd. and Pur'd ..	39,778	32,906	35,003	28,848	38,868	32,097	227,300	187,705

Note: Sales of each product are broken down into tons, pieces or some other unit. The Standard Cost System gives standard costs per ton or per unit and in the case of miscellaneous items gives the percentage relation of standard group cost to group sales price.

Figure 130. Budgeted Cost of Sales

MATERIALS BUDGET. The material and labor budgets overlap both the production planning and the cost of sales budgets, since in both cases information concerning quantities as well as costs is needed. The following information is needed in preparing a budget for materials:

1. Quantity and cost of each material that will be needed to satisfy budgeted production requirements
2. A monthly schedule of material needs in order that the materials may be on hand at the time they are needed
3. Information with respect to inventories desired

Purchasing policy is an important factor, for some companies prefer to purchase in quantity and carry sizable stocks of materials while others follow a hand-to-mouth policy in buying. Availability of materials, policy with respect to engaging in or avoiding speculative purchasing, and the amount of working capital which can be tied up in inventories all influence the plans for purchasing. Despite all of these variations, the one objective of the material budget is to develop a plan whereby the correct material will be on hand when needed. Whatever the procedure in providing raw material, an estimate of purchases in dollars by months is essential if a complete budgetary control plan is to be operated. Normally, the purchase budget is in two parts, one covering direct materials and the other, supplies. While the cost of supplies used is included in the departmental expense budgets, these budgets do not report any estimated changes in the supplies inventory.

LABOR BUDGET. Analysis of operations required to produce the goods called for by the production budget makes it possible to determine the number of man-hours that will be worked in each production center. From these figures the number of employees by types and skills can be calculated. Plans can then be made to provide the necessary manpower by hiring and training new employees, reducing hours, or working overtime or extra shifts as may be needed.

MANUFACTURING OVERHEAD BUDGETS. In general, it is possible to classify overhead budgets under two headings:

1. Appropriation type
2. Control or flexible type

In the appropriation or lump sum type of budget, there is a fixed limit of each expenditure for a specific purpose. It is used extensively in governmental budgets which after proper approval become authorizations for particular items of expenditures whose upper limits are clearly set forth. Such budgets are also often used in industry, particularly in making appropriations for advertising, research and development, and maintenance.

Control or flexible budgets are based on proper departmentalization, adequate account classification, and measurement of productive activity or volume. These budgets have already been discussed in connection with setting of manufacturing overhead standards and need therefore no further presentation here.

Budget for Selling and Administrative Costs. The costs of selling and of sales promotion are budgeted by estimating the cost of carrying on the sales campaign planned. Since budgeting procedure varies somewhat for different classes of these expenses, they must first be classified in groups presenting like budgeting problems. For example, such a classification might be:

1. Advertising and sales promotion
2. Direct selling
3. Sales administration
4. Transportation
5. Warehousing and shipping
6. Clerical operations—order writing, keeping stock records, etc.
7. Credit and collection

The amount to be spent for the first three functions listed above is usually determined by the amount of sales effort planned whereas the remaining functions are more closely related to the actual volume of sales expected. Selling effort and actual sales do not necessarily coincide in any given period since a considerable amount of advertising and sales promotion may not bear fruit until future periods. Moreover, selling efforts are often increased and more money is spent for selling when sales decline than when sales volume is large.

BUDGETING ADVERTISING AND SALES PROMOTION. These expenses are ordinarily budgeted as a lump sum termed an appropriation. The amount appropriated for the purpose may be determined in any of several different ways such as:

1. A percentage of sales
2. A percentage of profit
3. An amount per unit of product in budgeted sales
4. According to specified objectives outlined in a plan for using advertising and sales promotion to attain calculated level of customer acceptance for the company's product

The advertising appropriation is often broken down according to the planned application to media costs, samples, missionary sales, and demonstration work. Advertising appropriations are made by some companies with comparatively little detailed planning of objectives and costs. While the difficulty of measuring results of advertising makes it impossible to budget advertising on as factual basis as production, nevertheless experience has shown that careful planning of expenditures and comparison of actual expenses with the budget avoids wasteful spending without impairing effectiveness.

Budgeting Other Costs. Direct selling costs (i.e., salesmen's salaries and commissions, travel expenses, etc.) are budgeted according to the plan which the sales department prepares for customer calls and other expenses of soliciting orders. The budget for this activity is best built up territory by territory since local sales supervisors are familiar with the local conditions. Past experience modified by any known changes furnishes the basis for estimating such expenses as travel and entertainment. Commissions are determined by the volume of sales expected. A schedule of budgeted expenses for a sales territory is shown in Figure 131.

SALES EXPENSE BUDGET

PERIOD: FIRST SIX MONTHS 19—

Sources of data:
Field Reports
Market Research Reports
Prepared by· F. L. HARVEY
Checked by: H. E. HOWELL

Northern Territory

	Jan.	Feb.	Mar.	Apr.	May	June	Total First 6 Months
	$	$	$	$	$	$	$
Compensation .	805	800	810	805	800	800	4,820
Travel	265	213	201	200	250	271	1,400
Engineering	10		10	10	10	10	50
Stationery and Supplies	20	15	20	15	20	10	100
Telephone and Telegraph.	60	50	60	60	60	60	350
Commission	. .				.	.	. . .
Miscellaneous	10	10	10	10	10	10	60
Catalogs	25	25	25	25	25	25	150
Dues and Subscriptions .	10		5		10	5	30
Fixed Charges . . .	47	47	59	47	47	58	305
Totals	1,252	1,160	1,200	1,172	1,232	1,249	7,265

FIGURE 131. Sales Expense Budget

Such expenses as warehousing, shipping, clerical work, and credit vary to some extent with expected volume of sales. It is often possible to set standard costs for these items and to use these standard costs to determine the total cost of the function by multiplying the standard cost for these functions by the number of units to be handled.

General administrative expenses consist largely of salaries, occupancy costs for office space, and minor items for supplies and equipment. These costs are relatively easy to forecast in most cases since a large proportion of them consist of fixed charges.

Plant and Equipment Budget. The plant and equipment budget covers expenditures to be made for such long-lived assets as land, buildings, machinery, and other kinds of equipment. Since the investment in these assets is often substantial in amount and since mistakes made are not easily rectified without loss, planning of expenditures is essential. Such planning should be in the form of a long-range program covering several years, as well as a plan for what is to be spent in the coming budget period. By doing this it is possible to avoid overexpansion during temporary peak activities, to take careful account of the additional fixed charges entailed in plant expansion, and to tie in with long-term borrowing necessitated by such expansion.

The long-range plan is usually based upon a forecast of probable trends in sales of the company's products. The principal objective of such a plan is to provide facilities for making goods in an efficient and economical manner. Since products undergo change or grow obsolete equipment must be steadily modernized or replaced in order for the company to take advantage of new developments for reducing cost and improving quality. Moreover, the most profitable business is usually in the field of new products and hence investment should be directed toward facilities for making new and profitable items as it is withdrawn from older investments which cease to be profitable because of product obsolescence or excessive competition. In industries such as petroleum production where depletion is an important factor, large expenditures must be made annually for development and exploitation of new sources of supply. The actual timing of expenditures depends upon urgency of the need, the availability of funds for the purpose, and the judgment of management.

In most companies requests for appropriations to cover items of plant and equipment originate with the departments using the equipment. They are made in writing and addressed to the chief executive and are usually subject to approval by the board of directors. Thus the factory manager may request replacement of an old machine with a newer and faster machine, the office manager may ask for the purchase and installation of new lighting equipment, and the sales manager may recommend buying additional trucks for delivery purposes. Each request for such an appropriation should be made in writing and should give a full description of the proposed project and the reasons why the investment is proposed. These may well cover the following:

1. Net cost of proposed investment. This includes transportation and installation costs less any trade-in or salvage value on the old equipment.
2. Average annual increase in revenue or reduction in cost
3. Conservative estimate of expected duration (in years) of above benefit
4. Amount necessary per year to pay for equipment (less salvage or trade-in) over its expected life
5. Net profit per year from proposed investment (item 2, minus item 4)

To the above might be added figures showing the average investment during the life of the asset (one half of the cost minus salvage or trade-in value) and the percentage of profit on that investment.

These requests for appropriations are usually summarized in the budget department. When the budget for the coming period is prepared, the projects to be carried out are approved and an appropriation for the purpose included in the budget. Large expenditures are commonly approved individually by top executives of the company; lump-sum appropriations are made to cover minor expenditures.

Cash Budget

Purpose. A company must have cash to meet its financial obligations when they fall due. Even a company which is profitable and fundamentally sound can find itself in financial difficulties if it does not plan ahead in order to have funds when needed. The purpose of the cash budget is to provide planning of cash receipts and disbursements. It is a phase of the operating budget because the latter determines in large measure the sources and needs for cash.

Procedure. Preparation of the cash budget involves the forecasting of cash receipts and of disbursements. In addition it may involve planning to meet a forecasted cash deficit or to utilize a cash surplus. It should be noted that in preparing the cash budget all items are considered on the cash basis rather than on the accrual basis. Thus expenses of the period which involve no cash disbursements (e.g., depreciation, accrued interest payable, expiration of prepaid insurance) are omitted from cash disbursements. Likewise accrued income (e.g., accrued interest receivable from which collections will not be made within the budget period), is omitted from cash receipts. The starting point

Source of data:
Ledger Experience
Prepared by: F. L. Harvey
Checked by: H. E. Howell 11/2/—

SCHEDULE OF ANTICIPATED COLLECTIONS FROM SALES

		Jan.	Feb.	Mar.	Apr.	May	June	Total Six Months	Charge to Res. for Bad Debts	Charge to Discounts	Unpaid at 6/30/—
Est. Sales to Customer Group R & S—Terms 1% 10 Net 90 Past experience shows 40% discount bills and 3% are bad		$	$	$	$	$	$	$	$	$	
Month	Amt. of Sales										
Oct.	9,000	5,170									
Nov.	9,500		5,415								
Dec.	9,700	3,840		5,529						40	
Jan.	11,500		4,554		6,555				345	46	
Feb.	10,824			4,287		6,170			325	43	
Mar.	12,278				4,862		6,998		368	49	
Apr.	11,327					4,486			340	45	6,456
May	12,070						4,780		362	48	6,880
June	10,901								327		10,574

Est. Sales to Customer Group
T, U, V, W—Terms 2% 10 Net 60
Past experience shows 60% discount
10% pay in 30 days
20% pay in 60 days
7% pay in 90 days
3% are bad

Month	Amt. of Sales										
Sept.	24,286	1,700									
Oct.	26,000	5,200	1,820								
Nov.	27,000	2,700	5,400	1,890							
Dec.	28,000	16,464	2,800	5,600	1,960					336	
Jan.	28,278		16,626	2,828	5,655	1,979			850	340	
Feb.	24,179			14,217	2,418	4,835	1,694		725	290	
Mar.	26,590				15,635	2,659	5,318		798	319	1,861
Apr.	25,041					14,725	2,504		751	300	6,761
May	26,346						15,492		790	316	9,748
June	27,966								839		27,127
Total Est. Monthly Collections		35,074	36,615	34,351	37,085	34,854	36,786	214,765	6,820	2,172	69,407

Balance Accts. Receivable 1/1/	$ 65,864	Collections	$214,765		
Sales 6 Mos.	227,300	Discounts	2,172	Balance 6/30/	$76,227
	$293,164		$216,937		

FIGURE 132. Forecasted Collections from Accounts Receivable

is a determination of the cash receipts and disbursements that will result from operations and from plant and equipment budgets.

Forecasting Cash Receipts and Disbursements. The principal sources of cash receipts are cash sales; collections from customers on account; collection of nonoperating revenue, such as interest and dividends on investments, sale of assets, etc.; miscellaneous sources such as tax refunds, etc.; borrowing or sale of capital stock. Sales to customers provide the most important source. The sales budget gives the total amount that may be expected from this source, but where sales are made on account, it is necessary to determine either the length of the average collection period or the average lag between the time of sale and time of collection. Figure 132 illustrates a schedule of forecasted collections from sales on account.

The principal disbursements consist of items to be paid for in the form of production costs, distribution costs, capital expenditures, dividends, interest, and prior period liabilities. Figure 133 illustrates some of these points.

Summarizing the Cash Budget. When cash receipts and disbursements have been forecasted, a summary is prepared and the forecasted cash balance is determined. Such a summary is illustrated in Figure 134. Since it is prepared by months, it is possible to learn when short-term borrowing becomes necessary and in what months repayments may be possible. In addition long-term financing must be planned in connection with capital additions.

Summarizing the Budget. When individual budgets have been prepared for each department of the company, these budgets are brought together for summary in the budget or accounting department. The process of summarizing comprises assembly, from the individual budgets, of the data necessary to prepare a forecasted balance sheet, income statement, and any desired schedules to support these two principal financial statements. These statements and schedules make up the summary or master budget.

The first step in summarizing the budget is to set up on a work sheet the post-closing trial balance of the general ledger from the end of the preceding period. Thus, if the budget is to cover the first six months of 1954, the general ledger trial balance as of December 31, 1953, is the starting point. Since the budget is usually prepared before the end of December, 1953, it is necessary to estimate some of these figures. Since data for most of the year are already available and also since the budget cannot be exact anyway, this estimating of the year-end trial balance should not be a source of serious error.

Sources of data· Detailed Budgets
Prepared by· F. L. Harvey
Checked by: H. E. Howell 11/4/—

SCHEDULE OF ANTICIPATED EXPENDITURES

Period: First Six Months 19—

		January	February	March	April	May	June	Total First 6 Months
a. For Labor:		$	$	$	$	$	$	$
Sales Expense Compensation	North	805	800	810	805	800	800	4,820
	South	1,080	1,060	1,065	1,065	1,065	1,065	6,400
	West	485	480	485	480	485	485	2,900
Admin. Expense—Officers' Salaries . .		2,835	2,830	2,835	2,835	2,835	2,830	17,000
Admin. Expense—Office Salaries . . .		1,167	1,167	1,166	1,167	1,166	1,167	7,000
Factory Labor		4,572	4,572	4,572	4,572	4,572	4,571	27,431
Mfg. Expense Indirect Labor		500	500	500	500	500	500	3,000
Fixed Oper. Expenses Indirect Labor		100	100	100	100	100	100	600
Total Expenses for Labor		11,544	11,509	11,533	11,524	11,523	11,518	69,151
b. For Traveling Expenses:								
Sales Department	North	265	213	201	200	250	271	1,400
	South	231	235	276	287	345	326	1,700
	West	151	82	111	92	133	111	680
Totals		647	530	588	579	728	708	3,780
c. For Stationery and Supplies:								
Sales Department	North	20	15	20	15	20	10	100
	South	40	20	30	30	30	30	180
	West	14	10	14	14	14	14	80
Administrative		100	50	50	100	50	50	400
Manufacturing		8	8	9	8	9	8	50
Total Expenses for Stationery and Supplies ..		182	103	123	167	123	112	810

Figure 133. Forecast of Disbursements

Source of data. Work Sheet
Prepared by: F. L. Harvey
Checked by: H. E. Howell 11/4/—

STATEMENT OF CASH RECEIPTS AND DISBURSEMENTS

Period: First Six Months 19—

	January	Actual	February	Actual	March	Actual	April	Actual	May	Actual	June	Actual	Total First 6 Months	Actual
	$		$		$		$		$		$		$	
Cash on Hand First of Month	95,000		94,551		99,707		101,844		104,433		109,953			
Receipts:														
Sales Collections	35,074		36,615		34,351		37,085		34,854		36,786		214,765	
Notes Receivable	Omitted for simplicity													
Interest														
Miscellaneous														
Total Receipts . . .	35,074		36,615		34,351		37,085		34,854		36,786		214,765	
Disbursements:														
Labor and Salaries .	11,544		11,509		11,533		11,524		11,523		11,518		69,151	
Materials for Production	14,117		14,117		14,117		14,117		14,117		14,117		84,702	
Materials for Resale	7,311		2,940		.		6,860		980				18,091	
Traveling Expense	647		530		588		579		728		708		3,780	
Stationery and Supplies	182		103		123		167		123		112		810	
Telephone and Telegraph	220		195		221		209		215		210		1,270	
Dues and Subscriptions	95		50		95		60		90		105		495	
Engineering	127		51		127		77		77		77		536	
Commissions . .	175		60		75		64		75		75		524	
Repairs to Real Estate	25		30		30		60		30		25		200	
Taxes			1,020		4,200		. . .				. .		5,220	
Fire Insurance	.				. . .		. .		504				504	
Shop Liability Insurance	10		10		10		10		10		10		60	
Advertising	950		725		975		650		742		725		4,767	
Miscellaneous	120		119		120		119		120		120		718	
Total Disbursements .	35,523		31,459		32,214		34,496		29,334		27,802		190,828	
Cash Balance End of Month	94,551		99,707		101,844		104,433		109,953		118,937		118,937	

Figure 134. Cash Budget

Prepared by: F. L. HARVEY
Checked by: H. E. HOWELL 11/3/—

JOURNAL ENTRIES COVERING ANTICIPATED TRANSACTIONS

		January		February	
		Dr.	Cr.	Dr.	Cr.
		$	$	$	$
A	Accounts Receivable	39,778		35,003	
	Sales Our Manufacture		34,475		30,338
	Sales Purchased		5,303		4,665
	From Schedule ——				
B	Cash	35,074		36,615	
	Sales Discounts	376		386	
	Accounts Receivable		35,450		37,001
C	Bad Debts	1,195		1,050	
	Reserve for Bad Debts		1,195		1,050
	From Schedule ——				
D	Sales Expense North	1,252		1,160	
	South	1,900		1,650	
	West	800		700	
	Administrative Expense	4,286		4,231	
	Advertising	856		634	
	Fixed Operating Expense	61		68	
	Manufacturing Expense	1,809		1,809	
	Reserve for Depreciation		464		465
	Sundry Accrued Payable		10,500		9,787
	From Schedule ——				
E	Sundry Accrued Payable	977			43
	Reserve for Taxes		935	1,020	935
	Prepaid Insurance		42		42
	From Schedule ——				
F	Labor	4,572		4,571	
	Material for Manufacture	14,117		14,117	
	Sundry Accrued Payable		18,689		18,688
	From Schedule ——				
G	Labor Variance	4,572		4,571	
	Material Variance	14,117		14,117	
	Expense Variance	1,809		1,809	
	Labor		4,572		4,571
	Material for Manufacture		14,117		14,117
	Manufacturing Expense		1,809		1,809
	See Footnote [a]				
H	Inventory	20,391		20,390	
	Labor Variance		4,572		4,571
	Material Variance		14,117		14,117
	Expense Variance		1,702		1,702
	From Schedule ——				
J	Inventory Variance	107		107	
	Expense Variance		107		107
	See Footnote [b]				
K	Inventory	7,460		3,000	
	Sundry Accrued Payable		7,460		3,000
	From Schedule ——				
L	Std. Cost of Sales our Mfr.	28,205		24,713	
	Cost of Sales Purchased	4,701		4,135	
	Inventory		32,906		28,848
	From Schedule ——				
M	Variance from Std. Cost of Sales				
	Inventory Variance			15	
	From Schedule ——				15
N	Sundry Accrued Payables	35,672		31,519	
	Discount on Purchases		149		60
	Cash		35,523		31,459
	From Schedule ——				

[a] Closing Actual Cost into Variance Accounts.
[b] Closing Production Variance Accounts into Inventory Variance.

FIGURE 135. Summarizing Budget Through Journal Entries

WORK SHEET FOR BUDGET

FIRST HALF 19—

Prepared by: F. L. HARVEY
Checked by: H. E. HOWELL

	Trial Balance 1/1/—	Other Accounts January to June*		Profit and Loss						Balance Sheet 6/30/—
		Dr.	Cr.	January	February	March	April	May	June	
	$	$	$	$	$	$	$	$	$	$
Cash	95,000									118,937
January		35,074 B	35,323 N							
February		36,615 B	31,459 N							
March		34,351 B	32,214 N							
April		37,085 B	34,496 N							
May		34,854 B	29,334 N							
June		36,786 B	27,802 N							
Accounts Receivable	65,864									76,227
January		39,778 A	35,450 B							
February		35,003 A	37,001 B							
March		38,868 A	34,684 B							
April		36,368 A	37,453 B							
May		38,416 A	35,199 B							
June		38,867 A	37,150 B							
Inventory Raw Material	30,000	84,702 F	84,702 G							30,000
Inventory Finished Goods	198,900	122,345 H 18,460 K	187,705 L							152,000
Inventory Variance		642 J	180 M							462
Real Estate	100,000									100,000
Machinery	100,000									100,000
Fixtures and Equipment	78,700									78,700
Prepaid Insurance	168	252 E								420
Std. Cost of Sales Our Mfr.		160,845								

Variance from Standard Cost		180		28,205 L	24,713 L	27,504 L	25,735 L	27,183 L	27,505 L	
Cost of Sales Purchased		26,860			15 M	28 M	36 M	46 M	55 M	
Sales Discounts		2,172		4,701 L	4,135 L	4,593 L	4,297 L	4,541 L	4,593 L	
Bad Debts		6,820		376 B	386 B	333 B	368 B	345 B	364 B	
Sales Expense North		7,265		1,195 C	1,050 C	1,166 C	1,091 C	1,152 C	1,166 C	
South		10,805		1,252 D	1,160 D	1,200 D	1,172 D	1,232 D	1,249 D	
West		4,580		1,900 D	1,650 D	1,850 D	1,735 D	1,830 D	1,840 D	
Administrative Expense		25,525		800 D	700 D	775 D	735 D	780 D	790 D	
Advertising		4,200		4,286 D	4,231 D	4,246 D	4,285 D	4,236 D	4,241 D	
Fixed Operating Expense		300		856 D	634 D	881 D	556 D	647 D	626 D	
Manufacturing Expense		10,854 D	10,854 G	61 D	68 D	6 D	97 D	68 D		
Labor		27,431 F	27,431 G							
Labor Variance		27,431 G	27,431 H							
Material Variance		84,702 G	84,702 H							
Expense Variance		10,854 G	10,212 H							
			642 J							
Total Debits	668,632			43,632	38,742	42,582	40,107	42,060	42,429	656,746
Sundry Accrued Payables	14,117	138 E	60,742 D							14,117
		191,197 N	112,133 F							
			18,460 K							
Reserve for Taxes	7,435		390 E							7,825
Reserve for Bad Debts			6,820 C							6,820
Reserve for Depreciation	45,000		2,787 D							47,787
Sales Our Manufacture			197,000	34,475 A	30,338 A	33,687 A	31,520 A	33,294 A	33,686 A	
Sales Purchased Goods			30,300	5,303 A	4,665 A	5,181 A	4,848 A	5,122 A	5,181 A	
Discount on Purchases			369	149 N	60 N		140 N	20 N		
Capital	275,000									275,000
Profit and Loss				L 3,705	L 3,679	L 3,714	L 3,599	L 3,624	L 3,562	
Transferred to: Surplus	327,080									305,197
Total Credits	668,632	1,270,625	1,270,625	43,632	38,742	42,582	40,107	42,060	42,429	656,746

* Where there are many cash transactions, use horizontal columns to facilitate preparation of Cash Receipts and Disbursements statement.

FIGURE 136. Summarizing Budget through Work Sheet

Next, the transactions represented by the budgets are entered in much the same way that transactions are recorded in an ordinary accounting problem in which transactions for the period have been summarized (Figure 135). Journal entries should be written in the usual two column form to show what accounts are debited and what accounts credited. The sales budget (Figure 125) shows that sales of $39,778 are anticipated for January. A journal entry debiting accounts receivable and crediting sales is therefore written. By following through all transactions shown on the individual budgets, a complete journal for anticipated transactions in the coming budget period is produced. These journal entries are then posted to the adjustment columns in the work sheet (Figure 136). Skeleton ledger accounts could be used in place of the work sheet, but in practice a work sheet is used.

When the budgeted transactions have all been posted, they are combined with the opening trial balance and the resulting figures carried to columns for income statement and balance sheet items. From these latter columns the financial statements in the usual form are prepared. If desired, forecasted balance sheets could be shown at the end of each month.

Application of the Budget. When the budget has been prepared and approved as the company's operating plan for the coming period, each executive and supervisor should receive a copy of the part of the budget which covers his own section of the company. Ordinarily he will have helped prepare it and presumably is already familiar with it. Under these circumstances he has, in effect, set his own goal and therefore cannot later object on grounds that too much was expected of him.

Subsequently, as the period progresses and reports of actual operating results become available, statements should be prepared showing actual figures compared with budgeted figures. By use of such statements, performance relative to the budget is readily determined by each person who has responsibility for a departmental budget. As with standard costs, the principle of exceptions enables management to pick out items which are out of line, i.e., not in accord with the budget. Attention can then be centered on the variances. This takes the form of finding out why the differences arose and initiating corrective action where such a course seems desirable.

QUESTIONS

1. List the benefits accruing from a budget as they would be outlined to the management of a company interested in installing systematic budgeting.
2. Explain why a standard cost accounting system fails to achieve the objectives generally associated with a budget.
3. List five significant general economic indices which will be useful in preparing a sales budget. Indicate the sources for these indices.
4. What is the relation of sales budgeting to market analysis?
5. Differentiate between seasonal variations, secular trend, and residual fluctuations and indicate the purpose of such analysis in sales budgeting.
6. List the advantages attributable to a production budget.
7. In what ways does production budgeting for process industries differ from that in job order industries?
8. What period of time does a production budget cover and what factors determine its length?
9. What basic purchasing policies must be considered before preparing a materials budget?
10. Explain the differences in method in budgeting direct and indirect labor.
11. How are wage incentives and bonus plans reflected in the labor budget?
12. How does a manufacturing expense budget differ from the labor and material budgets?
13. What is the purpose of expense classifications based on behavior patterns displayed by these expenses?
14. What methods of analysis are available for semivariable expenses?
15. Discuss five alternative methods which may be used in setting the advertising budget.
16. Explain the significance of functional classifications in budgeting distribution costs.
17. Prepare a suitable form and explain its usage for a company interested in forecasting its inventory position through the application of budget methods.
18. What relationship is there between cash and operating budgets?
19. You are given the following facts for April:

Accounts receivable April 1	$ 60,000.00
Sales on account	300,000.00
Sales for cash	20,000.00
Notes receivable from customers	2,500.00
Accounts receivable April 30	41,000.00
Discounts taken average 2% of sales.	

Compute the cash receipts resulting from collections of accounts receivable.

20. From the following figures for July, prepare a forecast of cash disbursements:

Accounts payable July 1	$ 50,000.00
Purchases June	150,000.00
Purchases July	175,000.00
Notes given creditors	23,500.00
Accounts payable July 31	30,000.00

Discounts taken average 2% of purchases.
Only June purchases are paid for in July.

Chapter 23

COST REPORTS AND STATEMENTS

Nature of Reports. A report, as the term is used in cost accounting, is a summary prepared in analytical, tabular, or graphic form for the purpose of informing different levels of management concerning past or future operations or plans of a business and securing action thereon. The summary nature of a report becomes evident when it is considered that reports usually represent a condensation of detailed information taken from the records or other sources. Such reports may be presented in analytical, that is, essay form, as in the case of a report dealing with the possibility of a change in accounting procedure. Again the report may consist chiefly of tabular data illustrated by the familiar balance sheet, profit and loss statement, and many others. Finally, the information may be presented in the form of a graph, chart, map, or some other visual aid.

No matter what manner of presentation is adopted, the information is directed toward some particular individual either at the operating, i.e., departmental level, or some higher supervisory authority. The substance of the report may be purely historical; that is, it may deal with past events, or it may look to the future as in the preparation of a budget. Finally, it must be understood that the *immediate* objective of a report is to secure action on it. Reports are not made for their own sake; they are not an end in themselves, only a means to an end. They represent the finished product of the accountant and no matter what his technical skill, his value to the business is measured by the usefulness of the reports. Such usefulness is evidenced if it results in some action being taken, either positive or negative.

Cost Analysis and Cost Control. The need for action on reports is an indication of their ultimate objective—the control over operations of a business. Control is a matter of executive action. For such control to be effective the executive acts on information contained in reports, obtained by a process of analysis. Hence analysis and control represent a cause and effect relationship.

From what has already been said it is evident that by control is meant the guidance of the internal operations of all divisions of the business to produce the most satisfactory profits at the lowest cost. But guidance is a double-edged weapon. It involves both responsibility and authority for action. An executive at any level cannot be held responsible for a course of action unless he has the requisite authority. Conversely, authority should not be granted unless the person involved is held responsible for the results.

In reality there are two kinds of control:

1. Control at the source
2. Control through reports

Control at the source takes place at the operating level, usually on the basis of physical, on-the-spot observation by the foreman or other executive responsible for the performance of the men under him. Because of the size and complexity of modern business, control at the source is not always possible and even where it occurs it is supplemented by reports at different managerial levels where each level is held responsible for action at the next lower level. Thus while foremen are responsible at the operating level, supervisors at the divisional level are held accountable for actions of the foremen, while top executives are responsible for divisional performances as well as matters of policy. It becomes evident therefore that, as an organization increases in size, management must rely more and more on reports and less on visual familiarity and personal contact in order to control operations and results. What is needed therefore is a structure of reports presenting as nearly as may be a complete, objective picture of the business.

Types of Control Objectives. It is possible to distinguish two types of control objectives. The first is *financial* or profit control which is concerned with realization of the profit aim of the business through adjustment of selling price, promotion of the most profitable product or products, and maintenance of working capital and of net worth. The second is *cost* control which involves guiding the operations of a business on the basis of information as to costs and expenses. More specifically cost control involves inventory control, control over efficiency of men and machines, of material usage, and other costs. In both cases the ultimate result is a balance sheet and a profit and loss statement. In many cases also the cost reports eventually furnish supporting details for financial statements.

Classification of Reports. The classifications presented below are in many ways overlapping and are not intended to present separate air-tight categories. The most important classifications may be considered from the following viewpoints:

1. In relation to outside world
   a) Internal
   b) External
2. Levels of responsibility
3. By elements of cost
4. Form
5. Purpose or uses
6. Frequency
7. Methods of preparation
8. Geographical
9. Method of presentation

The first of these has already been discussed and therefore needs no further explanation. The second is discussed briefly below; the others are discussed in detail later in this chapter.

Levels of Responsibility. Reports may be presented to minor, intermediate, or general executives. Some reports are addressed exclusively to one level, others to two or more levels. Minor or junior executives consist of foremen, section chiefs, master mechanics, and chief storeskeeper. It is evident that these are the persons that direct performance at first hand. Hence the reports reflect the close relationship between the executive in question and the workers. It is at this level that performance is most easily controlled through fairly frequent reports, ranging from daily to weekly or monthly reports. Examples of such reports are performance reports for foremen, material reports for storeskeepers, and reports on controllable expenses.

Intermediate executives cover those who are in charge of a division of a business carrying on a group of closely related activities or whose duty it is to supervise the activities of a group of minor executives. Production superintendents, purchasing agents, office managers are examples in point. These persons may be considered as technicians and are characterized by long training and experience. Reports addressed to them summarize divisional activities. While they may receive certain daily and weekly reports, they are concerned with longer periods and hence receive some of the more important reports or copies of them issued monthly, quarterly, and yearly.

General executives consist of the chairman of the board, corporate officers, and staff executives, as distinguished from line executives, including the general manager and controller. They are in charge of major activities of the business, usually cutting across divisional lines. Their duties on the one hand are to maintain proper efficiency in each division and to coordinate the activities of the various divisions. On the other hand they are also concerned with the ultimate objective of the business: to secure an adequate return on the investment. Accordingly they must think of their enterprise in relation to external economic conditions. They are concerned with plans for the future, both short range and long range; they must study costs in relation to the business cycle; in short, theirs is the task of formulating company policies and translating those into desired action patterns. A striking example is furnished in the organization manual of the Victor Division of the Radio Corporation of America. In defining the duties of the director of accounts and finance this manual sets forth among others the following:

1. Participate in the development of over-all RCA Victor Division policies and the establishment of division-wide, sound, practical financial, accounting, budget, tax, and insurance policies and procedures.
2. Represent top management's interest in the administration of all accounts and finance matters division-wide through direction of the accounts and finance department and its various divisions.
3. Arrange for . . . operating methods of the division and compliance with standard procedure instructions . . .
4. Advise the operating vice president of significant changes and trends in the profit and financial status, and on budget performance of the division, productive departments, and plants.

Requisites of Reports. In the planning of the report system certain requisites should clearly be kept in view. These may be summarized under the following headings:

1. Economy of time and effort
2. Physical make-up
3. Time of presentation
4. Content
5. Adaptation to executives

ECONOMY OF TIME AND EFFORT. It is only common sense to conserve time and effort on the part of those preparing reports and those that must read them. From the point of view of the former the most important point to be kept in mind is the emphasis on significant facts only, or what has been referred to as the *principle of exceptions.* As long as events take their expected course, they are hardly worth reporting. By emphasizing the exceptions the executive can concentrate on them rather than spend time looking into matters that seem to be perfectly normal. In this way compactness and flexibility are obtained. This principle becomes of ever greater importance at successively higher levels of executive responsibility.

Another way in which time and effort may be economized is through standardization of reports. This applies particularly to routine reports. These are reports that are regularly furnished and hence should follow a set pattern so that they may become familiar both to those preparing and those reading the reports. This may be achieved by having the same columnar arrangement, for example, in tabular reports, or better still, by having the form preprinted so that only the figures need be inserted in their proper place. In any event, uniformity of treatment enormously simplifies matters for all parties concerned.

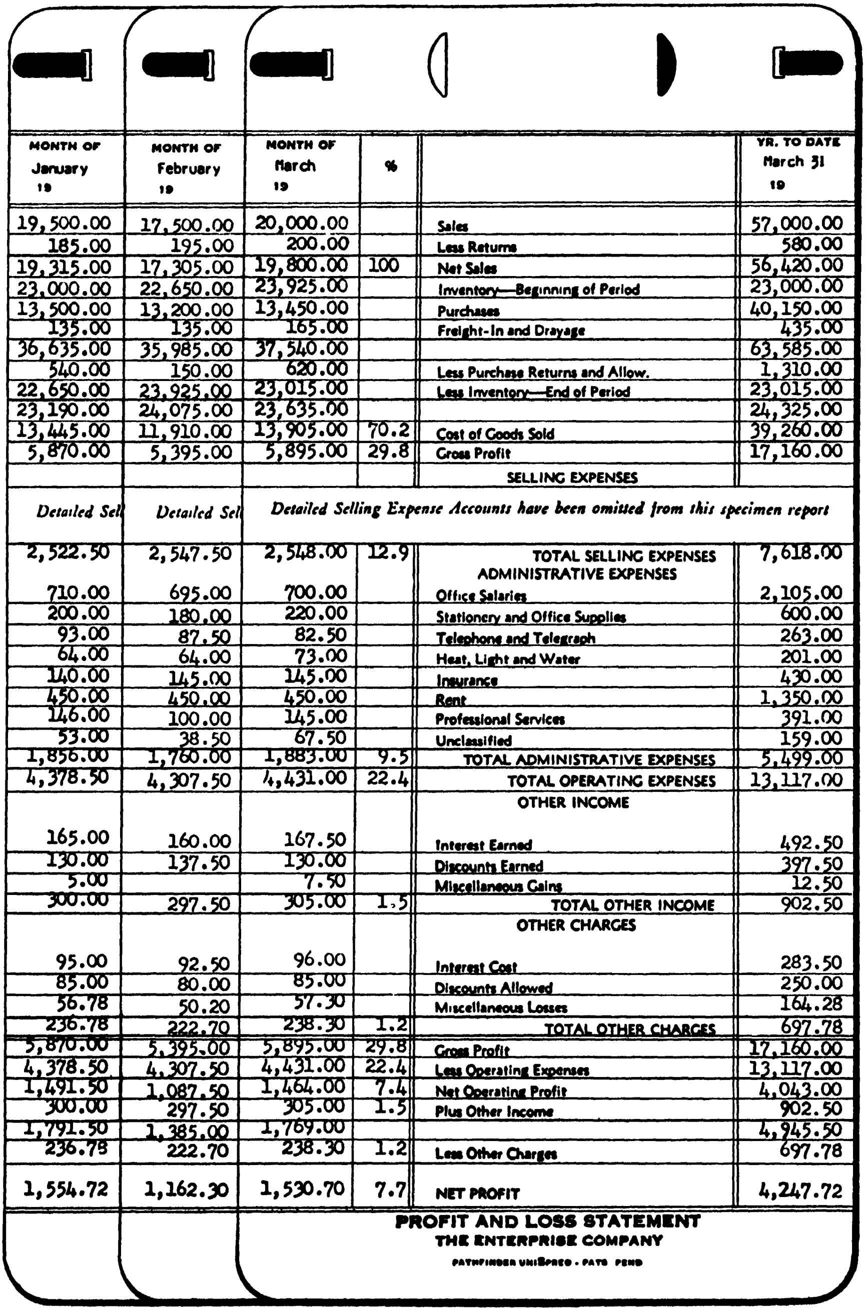
In the case of special reports, the above points do not hold. Here the only economy possible is to keep such reports at a minimum. A common error is to continue sending through reports period after period when the executive in question merely wanted the information on a single occasion.

Aside from the standardization of reports, discussed above, other economies are possible. For example basic data may be recorded in form for use in daily, weekly, or monthly reports. This could be accomplished by having a separate line on the report allotted for each day in the month with lines for weekly subtotals and monthly grand totals. Across the page are whatever headings are called for by the report plus a cumulative column. In this way as daily totals are entered, the total to date is automatically obtained. The same is true of weekly and monthly totals.

For greater effectiveness, statements are sometimes prepared on so-called strip forms (Figure 137). When placed in their proper binder or folder two types of comparisons can readily be made without the necessity for rewriting the data. By spreading the strips to the right, corresponding columns are exposed giving a complete month-to-month or other periodic comparison. Similarly, by spreading the forms to the left, comparisons are available of the current figures with the cumulative or year-to-date figures.

Physical Make-Up. The basic principle from the viewpoint of the physical appearance of reports is to keep them simple, understandable, and as brief as circumstances permit. So far as possible it is wise to avoid the use of large analysis sheets covered with many figures. It is best too to keep the figures themselves to a minimum, free from burdensome detail since few people possess the ability to read and digest pages crammed with figures.

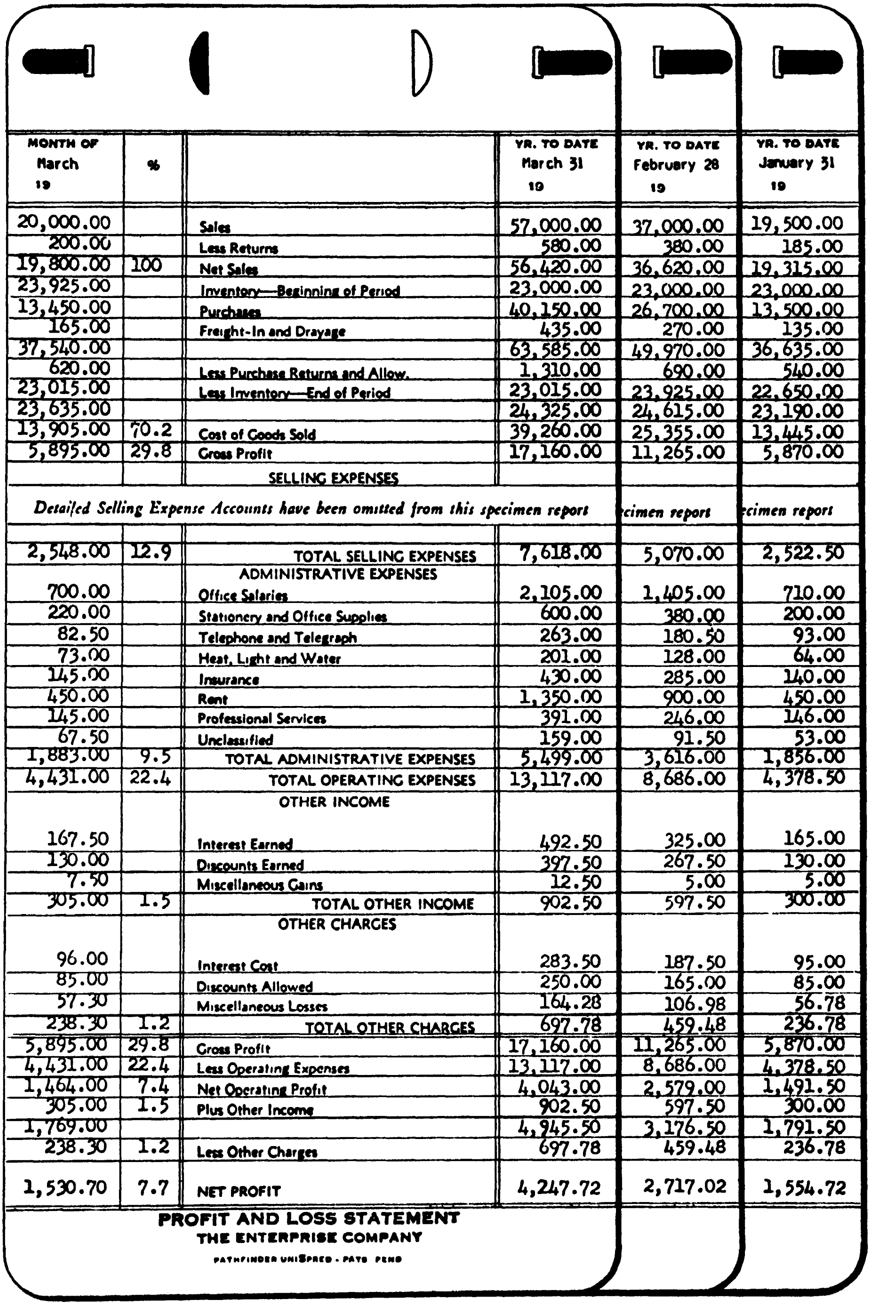
A second principle to be observed is the employment of clear descriptions. These include the use of titles and subtitles that exactly describe the content of a report or a section of it. Included also are the use of proper columnar headings, date of report, period covered or, in case of balance sheet items, the date as of which the figures are valid.



MONTH OF January 19	MONTH OF February 19	MONTH OF March 19	%		YR. TO DATE March 31 19
19,500.00	17,500.00	20,000.00		Sales	57,000.00
185.00	195.00	200.00		Less Returns	580.00
19,315.00	17,305.00	19,800.00	100	Net Sales	56,420.00
23,000.00	22,650.00	23,925.00		Inventory—Beginning of Period	23,000.00
13,500.00	13,200.00	13,450.00		Purchases	40,150.00
135.00	135.00	165.00		Freight-In and Drayage	435.00
36,635.00	35,985.00	37,540.00			63,585.00
540.00	150.00	620.00		Less Purchase Returns and Allow.	1,310.00
22,650.00	23,925.00	23,015.00		Less Inventory—End of Period	23,015.00
23,190.00	24,075.00	23,635.00			24,325.00
13,445.00	11,910.00	13,905.00	70.2	Cost of Goods Sold	39,260.00
5,870.00	5,395.00	5,895.00	29.8	Gross Profit	17,160.00
				SELLING EXPENSES	
Detailed Sel	*Detailed Sel*	*Detailed Selling Expense Accounts have been omitted from this specimen report*			
2,522.50	2,547.50	2,548.00	12.9	TOTAL SELLING EXPENSES	7,618.00
				ADMINISTRATIVE EXPENSES	
710.00	695.00	700.00		Office Salaries	2,105.00
200.00	180.00	220.00		Stationery and Office Supplies	600.00
93.00	87.50	82.50		Telephone and Telegraph	263.00
64.00	64.00	73.00		Heat, Light and Water	201.00
140.00	145.00	145.00		Insurance	430.00
450.00	450.00	450.00		Rent	1,350.00
146.00	100.00	145.00		Professional Services	391.00
53.00	38.50	67.50		Unclassified	159.00
1,856.00	1,760.00	1,883.00	9.5	TOTAL ADMINISTRATIVE EXPENSES	5,499.00
4,378.50	4,307.50	4,431.00	22.4	TOTAL OPERATING EXPENSES	13,117.00
				OTHER INCOME	
165.00	160.00	167.50		Interest Earned	492.50
130.00	137.50	130.00		Discounts Earned	397.50
5.00		7.50		Miscellaneous Gains	12.50
300.00	297.50	305.00	1.5	TOTAL OTHER INCOME	902.50
				OTHER CHARGES	
95.00	92.50	96.00		Interest Cost	283.50
85.00	80.00	85.00		Discounts Allowed	250.00
56.78	50.20	57.30		Miscellaneous Losses	164.28
236.78	222.70	238.30	1.2	TOTAL OTHER CHARGES	697.78
5,870.00	5,395.00	5,895.00	29.8	Gross Profit	17,160.00
4,378.50	4,307.50	4,431.00	22.4	Less Operating Expenses	13,117.00
1,491.50	1,087.50	1,464.00	7.4	Net Operating Profit	4,043.00
300.00	297.50	305.00	1.5	Plus Other Income	902.50
1,791.50	1,385.00	1,769.00			4,945.50
236.78	222.70	238.30	1.2	Less Other Charges	697.78
1,554.72	1,162.30	1,530.70	7.7	NET PROFIT	4,247.72

PROFIT AND LOSS STATEMENT
THE ENTERPRISE COMPANY
PATHFINDER UNISPRED · PATS PEND

FIGURE 137*a*. Strip Form (comparison by months and year-to-date)



MONTH OF March 19	%		YR. TO DATE March 31 19	YR. TO DATE February 28 19	YR. TO DATE January 31 19
20,000.00		Sales	57,000.00	37,000.00	19,500.00
200.00		Less Returns	580.00	380.00	185.00
19,800.00	100	Net Sales	56,420.00	36,620.00	19,315.00
23,925.00		Inventory—Beginning of Period	23,000.00	23,000.00	23,000.00
13,450.00		Purchases	40,150.00	26,700.00	13,500.00
165.00		Freight-In and Drayage	435.00	270.00	135.00
37,540.00			63,585.00	49,970.00	36,635.00
620.00		Less Purchase Returns and Allow.	1,310.00	690.00	540.00
23,015.00		Less Inventory—End of Period	23,015.00	23,925.00	22,650.00
23,635.00			24,325.00	24,615.00	23,190.00
13,905.00	70.2	Cost of Goods Sold	39,260.00	25,355.00	13,445.00
5,895.00	29.8	Gross Profit	17,160.00	11,265.00	5,870.00
		SELLING EXPENSES			
Detailed Selling Expense Accounts have been omitted from this specimen report				*cimen report*	*cimen report*
2,548.00	12.9	TOTAL SELLING EXPENSES	7,618.00	5,070.00	2,522.50
		ADMINISTRATIVE EXPENSES			
700.00		Office Salaries	2,105.00	1,405.00	710.00
220.00		Stationery and Office Supplies	600.00	380.00	200.00
82.50		Telephone and Telegraph	263.00	180.50	93.00
73.00		Heat, Light and Water	201.00	128.00	64.00
145.00		Insurance	430.00	285.00	140.00
450.00		Rent	1,350.00	900.00	450.00
145.00		Professional Services	391.00	246.00	146.00
67.50		Unclassified	159.00	91.50	53.00
1,883.00	9.5	TOTAL ADMINISTRATIVE EXPENSES	5,499.00	3,616.00	1,856.00
4,431.00	22.4	TOTAL OPERATING EXPENSES	13,117.00	8,686.00	4,378.50
		OTHER INCOME			
167.50		Interest Earned	492.50	325.00	165.00
130.00		Discounts Earned	397.50	267.50	130.00
7.50		Miscellaneous Gains	12.50	5.00	5.00
305.00	1.5	TOTAL OTHER INCOME	902.50	597.50	300.00
		OTHER CHARGES			
96.00		Interest Cost	283.50	187.50	95.00
85.00		Discounts Allowed	250.00	165.00	85.00
57.30		Miscellaneous Losses	164.28	106.98	56.78
238.30	1.2	TOTAL OTHER CHARGES	697.78	459.48	236.78
5,895.00	29.8	Gross Profit	17,160.00	11,265.00	5,870.00
4,431.00	22.4	Less Operating Expenses	13,117.00	8,686.00	4,378.50
1,464.00	7.4	Net Operating Profit	4,043.00	2,579.00	1,491.50
305.00	1.5	Plus Other Income	902.50	597.50	300.00
1,769.00			4,945.50	3,176.50	1,791.50
238.30	1.2	Less Other Charges	697.78	459.48	236.78
1,530.70	7.7	NET PROFIT	4,247.72	2,717.02	1,554.72

PROFIT AND LOSS STATEMENT
THE ENTERPRISE COMPANY
PATHFINDER UNISPRED - PATS PEND

FIGURE 137*b*. Strip Form (cumulative monthly totals)

Third, it is always a good idea to present summary findings first before proceeding with supporting detail. This is a familiar principle especially in financial accounting, and is a good one to follow in cost accounting. In this way the vital information is highlighted first and the executive is in a position to follow up supporting detail to the extent desired.

Fourth, reports should be prepared so far as possible in comparative form. The comparisons may be against past performance, against standards, or against budget figures.

A final point to be kept in mind concerns the attractiveness of the report. This involves the presentation of the report data as interestingly as possible, particularly in an analytical type of report. It goes without saying that neatness, spacing, standardized forms and sizes are all points to be considered in this connection.

Time of Presentation. The important points to be kept in mind in connection with the proper time of presenting reports are promptness, up-to-dateness, and accuracy. The importance and validity of figures deteriorate rapidly with the passage of time. It is therefore of the utmost importance to avoid having the figures get stale. Many items should therefore be presented almost as soon as they occur; daily, if necessary. It is not uncommon, where valuable materials are used in production, to get reports on material usage *twice* a day. This is for the purpose of heading off further material losses in case a report shows a sudden rise in material usage as compared with standard.

It is at this point that the requirements of accuracy come into conflict with those of promptness. Accuracy demands audit or verification of data and this takes time. Thus if figures, before being released, have to be tested, the report is likely to be delayed and loses much of its value. Two remedies, adopted by many concerns have been found possible:

1. Rounding off dollar amounts and percentages
2. Release of preliminary data, followed by final data at a later time

The first of these is distinctly worth while. Where many figures are involved and many percentages to be calculated, the saving in time is substantial if these figures are conveniently rounded off. Even where unit costs are calculated, the latter should be carried only as far as necessary to reveal significant differences. It is seldom that unit costs in the fifth or sixth decimal place are of much consequence.

A very common device in use by many concerns is to issue *preliminary* reports and, later on, final reports. Where good internal audit control is in force, the preliminary data are themselves likely to be quite accurate. In fact, many concerns have found that the final figures differ from the preliminary reports by a very small percentage, and that therefore it pays to sacrifice that small degree of accuracy in order to issue the preliminary reports promptly.

The frequency with which a given report is issued determines to a large extent how up-to-date it is. This in turn depends on the needs of the executives, on whether it is a routine or special report, on the degree of executive responsibility and the nature of the items reported. For example, a report on labor efficiency of individual workmen should be made to a foreman daily. It is he who must stop inefficiency at the source. But a similar report to the production superintendent either need not be made or, if made, can be submitted perhaps once a month. What the superintendent wants is merely to see how well the *foremen* are doing their jobs. He is therefore not interested in individual workers' daily performances except as a means toward achieving the above objective. In his case the weekly and monthly figures submitted merely confirm the day-to-day figures of control at the source.

Content of Reports. In general, reports like the chart of accounts should follow the organization structure. Within each level of responsibility, the executive should be kept informed of the details of the group of activities immediately under his jurisdiction. In addition he may be given some general results of the rest of the business. The really important factor, however, is to emphasize his responsibility. In the nature of things therefore only the controllable items of cost should be stressed in a report; i.e., the executive is held responsible only for those items over which he exercises control. These include the variable costs and the variable portion of semifixed expenses. The noncontrollable items, that is, fixed costs and fixed portions of semifixed expenses may be included for purely informational purposes, provided they are separated from the controllable items.

Adaptation to Executives. It is a truism to say that reports must be adapted to the executive receiving them. The "boss" is entitled to his preferences and such preference of course governs the form and manner of presentation. In addition the report should meet a definite need and tell a definite story by being as specific as possible.

In the case of special reports the necessity for adaptation is even more striking. Such reports, merely because they *are* special, can be presented with more force than routine reports. Special reports usually require a careful analysis of a problem or situation, followed by a conclusion involving recommendations.

The final point in adaptation lies in the method of presentation of the report. This may be oral, written, or in graphic or other form, or some combination of these. Oral reports are quite common. They may be made to an individual executive or to a group of executives in conference. The report may supplement a written report by explaining the chief features and leaving the executives to study the written report at leisure, or the oral presentation may take the place of a written report. In any event, oral reporting requires complete familiarity with the content. It is necessary for the reporter to plan the material to be gone over, and in case exhibits are to be shown he must be able to turn to the right table or chart without delay or confusion. It is necessary also in oral reporting to avoid extreme detail as most people would find it difficult to follow. Instead it is wise to try to anticipate questions as far as possible.

Written reports are often of the analytical, essay type. They serve as records of decisions made and guides for the future. If graphs or tables are part of the report they should be explained in the text and the appropriate conclusions drawn.

Graphs, ratios, and tabular presentations are often used either by themselves or in combination with the other forms of reporting. They appeal to some types of executives, particularly since they condense much information into a small space. Graphs are particularly suited for the study of time series where it is desired to study long-time trends, cyclical fluctuations, etc. Among types of graphs may be mentioned, besides the usual coordinate charts, bar charts, pie charts, picture charts, ratio charts, Gantt charts, break-even charts, and density maps.

The purpose of ratios is to point out relationships of certain factors, all of which affect comparative earnings of a business. Thus there are turnover ratios of inventories and of labor; efficiency ratios involving labor efficiency expressed as a figure per unit of product or per hour. Similar ratios may be used for material usage. Finally there is a host of ratios commonly employed in analysis of financial statements.

Organization of Report System. It is evident that in any fairly large concern a sizable number of reports is handled and it becomes quite a responsibility to keep track of them. Ordinarily this responsibility is vested in the chief accounting officer or other staff executive who initiates a survey of management's need for information. So far as possible the reports are related to the concern's organization chart in the sense that the information required by top executives sets the pattern for reports at lower levels. In this way information is collected showing the reports required, by whom they are required, and how often they are to be furnished.

In very large companies authority for the proper administration of the report system is vested in an office standards section. The latter registers all reports and provides for central filing of copies of all reports. Every report is numbered and all pertinent data are recorded including title, source of data, person preparing the report, date to be completed, and disposition of report by the one receiving it.

On the basis of the completion dates, a report calendar is drawn up, establishing a definite schedule for the issuance of each report. The schedule sets not only the day, but frequently the hour when the report is due and it becomes the duty of the standards section to follow through and see that each report is issued on time. This section also is of importance in the design of report forms. It issues instructions covering layout, size, and type of paper in an effort to secure uniformity of design of forms. Standard instructions are also issued covering the typing, binding, and number of copies. Finally the office standards section makes periodic checkups on reports being issued. Experience has shown that many reports are issued which are never used. It is the duty of the office standards section to inventory reports periodically and check their actual usefulness. If they are not being used permission may be asked to eliminate them. A simpler method is simply to drop the report temporarily and if no one complains, make the drop permanent. A watchful eye should also be kept on special reports. If there are too many of them, the standards section might well give some thought to the possibility of incorporating some of the special information in the regular reports and thus obviate the necessity for frequent special reports.

Specific Internal Reports. In the following pages a number of specific internal reports are described. Not every concern embraces all the reports mentioned. They are intended to be merely representative of report forms that are being used in practice and whose principles could be applied wherever a company thought the subject in question to be sufficiently important.

Types of Material Usage Reports. Figures 138 and 139 illustrate two possible forms that reports covering material usage may take. Figure 138, used by a textile company, is a report prepared for the manufacturing vice-president, superintendent of weaving rooms, and department handling raw materials. The report shows responsibilities by looms for material usage by comparing actual material consumption with the standard cost allowance.

The modern trend in cost reports is in the direction of greater use of quantity engineering data as opposed to dollar cost figures. This is due to two factors: first, standard costs are based on physical standards and hence reports are prepared more quickly by letting the physical standards speak for themselves rather than translating them into standard costs. Secondly, physical quantities are likely to be more readily understood than dollar totals, especially at the operating level. Figure 139 illustrates this method, although the report is shown in both physical quantities as well as dollar amounts. This report is issued daily to foremen and shows only those items on which the actual weights used exceed standard weights allowed. This enables foremen to concentrate their attention on those items in excess of standard. In general material usage reports are sent daily to foremen covering major items of material or, as in the above case, only the unfavorable ones. These reports show standard allowance, actual usage, variation, and, likely as not, per cent variation, or, as in Figure 138, per cent of actual to standard.

Loom No.	Standard Cost Allowance Inc. Waste	Actual Usage at Standard Prices	Usage Variation	% of Standard
1	$4,006	$ 3,993	$ 13	99.7
2	4,137	4,298	161*	103.9
3	4,692	4,623	69	98.5
Etc.				
19	3,786	3,973	187*	104.9
20	4,803	4,763	40	99.1
Totals	$86,735	$88,143	$1,408*	101.6

* Denotes unfavorable variance.

FIGURE 138. Material Usage Variance Report (in dollar amounts)

In addition weekly reports of material usage by parts and products are prepared by the cost department by summarizing the daily reports and providing, besides the figures on the daily reports, the cumulative variances since the beginning of the year or quarter or other convenient date. A monthly report is issued summarizing the cost variances by products or product classifications.

Scrap and Spoilage Reports. Somewhat different in character are the reports issued in connection with scrap and spoilage. It must be understood that spoilage is a symptom rather than a cause. By this is meant that spoilage is merely the visible evidence of some factor that causes or is responsible for it. Thus it is not enough for a foreman to answer that excessive usage is due to a heavy spoilage factor. That is not the cause; actually it is necessary to start a chain of investigation to discover why the spoilage occurred. At the start of a run, particularly where design changes have taken place and it is necessary to get the "bugs" out of the product, heavy spoilage is to be expected.

The essentials of reporting scrap and spoilage may be stated to consist of complete information, especially on major items, prompt report-

USAGE OF COMPOUND ON WHEELS

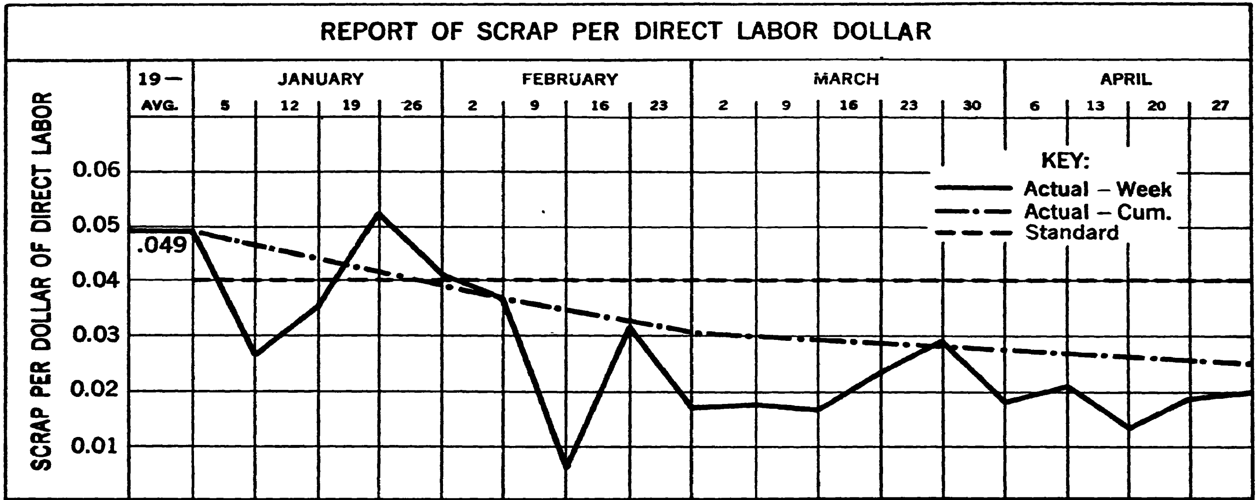
WEEK ENDING APRIL 3, 19—

Part No.	No. of Wheels Prep.	Std. Wght. Per Wheel	Total Std. Lbs. Per Whls. Prep.	Net Lbs. Comp. Used on Wheels	Lbs. Variance from Std.	Aver. Cost Per Lb.	Cost Variance	
							Current Week	Cumu-lative
500170	3,430	2.875						
750992	27,176	2.594						
751062	105	2.188						
751738	3,761	3.508						
752610 . .	15,601	2.016						
All Wheels Using 6165 Compound .			125,232	125,136	96	$ .04675	$ 4.49	$ 242.96*
All Wheels Using 6286 Compound . . .				—52	52	.05310	2.76	818.66*
Mixed Compound Scrapped from Wheel Presses								1.81
						TOTAL COST VARIANCE	$ 7.25	$1,059.81*

* Unfavorable.

Factory Accounting Department

FIGURE 139. Report of Material Usage (in physical units and dollars)



	19—	JANUARY				FEBRUARY				MARCH					APRIL			
	AVG.	5	12	19	26	2	9	16	23	2	9	16	23	30	6	13	20	27
DIR. LABOR	WEEK	1793	2200	2151	2380	2229	2250	2193	2185	2093	2355	2397	2288	2066	1914	2179	2195	2115
	CUM.		3993	6144	8525	10754	13004	15197	17383	19476	21831	24228	26516	28582	30496	32675	34870	36985
ACT. SCRAP	WEEK	49	77	114	97	82	12	69	37	38	39	58	65	38	40	28	41	41
	CUM.		126	240	337	419	431	500	537	575	614	672	737	775	815	843	884	925
STD. SCRAP	WEEK	72	88	86	95	89	90	88	87	84	94	96	91	83	77	87	88	84
	CUM.		160	246	341	430	520	608	695	779	873	969	1060	1143	1220	1307	1395	1479
VARIANCE	WEEK	23	11	−28	−2	7	78	19	50	46	55	38	26	45	37	59	47	43
	CUM.		34	6	4	11	89	108	158	204	259	297	323	368	405	464	511	554
SCRAP PER DIR. LABOR	WEEK	.027	.035	.053	.041	.037	.005	.032	.017	.018	.017	.024	.029	.018	.021	.013	.019	.020
	CUM.		.031	.039	.039	.039	.033	.033	.031	.029	.028	.028	.028	.027	.027	.026	.025	.025

FIGURE 140. Graphic Report of Scrap (based on per cent of labor cost)

ing, and placing of responsibility for scrap. Generally, loss is measured in the form of a ratio (Figure 140) based on some factor of variability or against a standard allowance. The starting point is usually a daily report on major volume products or on products in difficulty showing the quantity scrapped, good production, per cent scrap, part number, and, if desired, value. In the case of new products the daily reports may of course be discontinued as soon as it becomes evident that production is in line with standard. The report may be prepared by the cost department or may be in the form of an inspector's report of material rejected. Copies are provided for the general superintendent, planning, accounting, and inspection departments. Another valuable report is a daily report of spoilage by individual workmen. The latter enables the foremen to assist the workers in question to reduce spoiled work and also serves as a basis for payroll deductions in cases where workers are charged for spoilage.

On the basis of the daily reports, weekly and monthly summaries are prepared either by departments (Figure 141) or on a plant-wide basis. These usually provide for reporting current scrap and spoilage as well as cumulative figures.

Reports on Purchasing Activity. Action of the purchasing department with respect to buying policies influences both price and usage of material. Price is usually thought of as uncontrollable, since it is largely an outside factor. Nevertheless, the purchasing department can control price to some extent through efforts to obtain maximum cash discounts or quantity discounts, by placing orders in off seasons, spacing orders over a period of time, or by entering into contract obligations. To these may also be added such circumstances as use, by the manufacturing department, of a type of material costing more than that called for in the specifications because the purchasing department failed to maintain an adequate supply of the needed variety.

The extent to which the purchasing agent is responsible for price is a matter of administrative policy. Buying on basis of price alone may degenerate into speculation. It may also tie up needed working capital in large inventory items when such capital is needed for other items. Whether a purchasing agent shall be allowed discretion to buy when he considers conditions favorable must be decided on the merits of each case.

Reports on the purchasing department's activity are of special importance since material represents in many instances a substantial part of the cost of production. Actually, and in a narrow sense, the manufacturing division cares little about the purchase price of material used, but only about its quality, availability, and economical use. The purchasing department and top management, however, are vitally interested in the question of price. Where standard costs are used or where budgetary controls have been set up it is the responsibility of the purchasing department to purchase within the allowed standards and thus protect the budgeted net profit. Of course, some price variances result from changes in external circumstances over which the plant has no control. Hence these variances are not always to be regarded primarily as indexes of personal performance by the purchasing officer, but instead as indicators of possible needs for changes in standards, in the product price, or in the kinds of materials used.

DATE *January 19-*

REPORT OF SCRAP FOR DEPT. *Pasting*

Date	Production	Scrap	%	Remarks
1				
2	69,150	373	0.54	
3	63,729	491	.77	
4	49,222	340	.69	
5	20,630	140	.68	
6				
7	65,887	474	.72	
8	59,110	520	.88	
9	38,799	330	.85	
10	52,578	379	.72	
11	47,920	379	.79	
12	18,333	125	.68	
13				
14	60,766	668	1.10	
15	54,585	513	.94	
16	49,345	400	.81	
17	51,446	473	.92	
18	43,252	402	93	
19	21,302	247	1.16	
20				
21	51,631	485	.94	
22	48,210	391	.81	
23	50,090	376	.75	
24	41,167	346	.84	
25	47,348	455	.96	
26	17,238	115	.67	
27				
28	59,861	569	.95	
29	46,033	488	1.06	
30	51,975	411	.79	
31	40,680	342	.84	
Total	1,220,287	10,232	.84	

Reverse Side

Month	Year	%
July	19—	1.04
Aug	"	.99
Sept.	"	1.10
Oct	"	1.15
Nov.	"	1 03
Dec	"	1.09

FIGURE 141. Monthly Scrap Report

A common method of reporting price variances is through weekly or monthly summaries drawn from the voucher register or other source where invoices have been recorded at actual and standard prices. The summary may be subdivided in any way desired. Its chief usefulness lies in the ability to separate cost variations for the purchasing and the manufacturing departments and the determination of the efficiency of each of these divisions.

Reports on Direct Labor. In line with the managerial exception principle, analysis of direct labor cost may well center around the variations from standard. Since labor cost is a function of two factors, wage rates and time, it follows that variations from standard must be quantitatively analyzed in terms of those factors.

The immediate control of direct labor cost is, in most concerns, in the hands of foremen. This requires that they be provided with reports daily or weekly to help them in keeping this element of cost within standard limits. Where the rates paid are determined by a contract with a union or by executives other than foremen, only the usage and selection of the correct grade of labor is chargeable to foremen.

Rate Variances. The problem of adequate labor relations may be said to overshadow in importance every other cost problem. In reporting on prices paid for labor the objective is to provide top management with a grasp of labor relations problems. To that end, management should be furnished with data necessary in labor negotiations. These include:

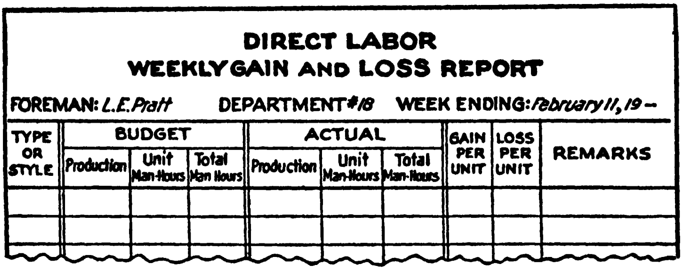
1. Trend in labor rates: per cent of employees in each pay bracket, shifts in pay brackets
2. Wage rates compared with rates in industry generally
3. Straight time hourly earnings as an aid in job classification and formulation of wage rate policy

The most obvious cause of rate variances is occasioned by changes in labor rates whether the changes were generally authorized or are in line with company policy. Aside from authorized increases, wage rate variances may result from the employment of high-rate employees on low-rate tasks or from overtime work necessitating premium rates for the overtime period. In the former case an increase in the average hourly rate of a department takes place, although no one has been given a wage increase. In the case of overtime a similar increase takes place, due to the premium wage paid for the excess hours. The presence of both should be checked constantly through reports.

Labor Efficiency. The second cause of excess labor cost lies in the time factor, and concerns the use of an excessive number of labor hours to perform a given quantity of work. Not only are the reasons more numerous than those which create labor rate variances, but they are also harder to discover and control. Consequently, the bulk of labor reports is devoted to the time element. The first kind of report found essential in this category is a daily comparison of standard and actual direct labor. This may be expressed in man hours or dollars or both. The comparison may be in the form of a daily labor analysis by individual jobs or by operations with further subdivision showing efficiency of individual workers. This serves to indicate whether the variance is a chance phenomenon or occurs regularly. A column for cumulative figures may be added.

A comparison between estimated or budgeted unit man hours and actual unit man hours, revealing either a gain or loss, is provided in

Figure 142. Study of such a report may lead to an investigation of the effectiveness of labor and to a revision of labor policies. Tracing back to causes, there may be revealed that the right man was not placed in the right job; that a foreman has failed to secure cooperation of workers; that training and instruction of new workers was inefficient and faulty; that wage incentive plans were lacking; or that labor turnover was excessive. Information thus presented and compared has a direct bearing upon individual productivity of workers under the foreman of a department. The report covers a week, but a similar report should be prepared daily.



DIRECT LABOR
WEEKLY GAIN AND LOSS REPORT

FOREMAN: *L.E. Pratt* DEPARTMENT *#18* WEEK ENDING: *February 11, 19–*

TYPE OR STYLE	BUDGET			ACTUAL			GAIN PER UNIT	LOSS PER UNIT	REMARKS
	Production	Unit Man-Hours	Total Man Hours	Production	Unit Man-Hours	Total Man-Hours			

FIGURE 142. Weekly Report of Direct Labor Efficiency

Other weekly reports on labor efficiency may include the following:

1. Summary of productive workers operating at less than standard efficiency
2. Summary of bonuses earned
3. Departmental labor efficiency
4. Analysis of productive labor hours charged to nonproductive activities

In addition there may be monthly reports by departments covering labor performance on all orders completed during the month. A very common monthly report is one covering labor turnover. By the latter is meant the ratio of separations or replacements to the total number of employees. It is calculated by dividing the total number of separations by the average number of employees. This may be illustrated as follows:

Number of employees beginning of period	200
Number of employees end of period	250
Average number during period $\left(\frac{200 + 250}{2}\right)$	225
Number of separations	30
Labor turnover (30 ÷ 225)	.133

Many companies in computing labor turnover divide it into different groups according to causes, such as layoffs, quits, and discharges with a fairly complete analysis of the reasons for voluntary leaving. Some companies make a distinction between preventable and unpreventable turnover, putting into the latter classification those separations which result from reductions in the working force or from deaths of workers. Likewise some companies record turnover separately for old and new employees, for men and women, for skilled and unskilled labor, and for other factors of difference.

If turnover is high because of voluntary separations, the causes should be found and corrected. An exit interview of a friendly nature should be held with all employees severing company connections. All causes that are the faults of the company or supervisors or other controllable factors should be investigated and corrective measures taken to eliminate the trouble. To neglect correction is to lay the groundwork for more serious labor troubles later on.

Manufacturing Overhead Reports. Only by being made constantly aware of the cost of production can costs be kept within prescribed limits. So many opportunities for waste exist that every means must be utilized at all levels of executive responsibility for aiding operatives to turn out production with reasonable economy. The question of who is blaming whom for poor performance must be replaced by teamwork where everyone is working towards a common goal: the best product at lowest cost. These sentiments apply of course to all elements of cost, but they hold true with particular force of manufacturing expense because the latter is less susceptible of exact measurement and calls for greater exercise of human judgment.

The primary aim of expense reporting is to aid the twin problems of cost control and cost reduction. The factors involved in the solution of these problems are the analysis of expense by behavior into fixed, variable, and partially variable expenses. The results are evidenced in reports showing comparison with standards or with budget figures through variance analyses.

Control Through Budgets. Indirectly, control through standards is one aspect of budgetary control. This is because at standard capacity the allowed expense per unit equals the standard expense per unit. Since, however, a plant does not always operate at standard capacity, use is made of flexible budgets to obtain expense allowances at various capacity levels. By comparing actual expenses of producing departments with the budget allowance based on the actual production level attained, the necessary control variances are obtained. In the case of service departments the budget allowance is based on the general plant activity reached or, if possible, on some specific index of activity of the particular service department.

	Standard Cost	Actual Cost	Cost Variations	Cause of Variations			Foremen's Budget	
				Level of Operations	Management Changes	Foremen's Efficiency	Budget Allowance	% Actual of Budget
SERVICE COST CENTERS:								
Boiler								
Power								
Plant and Building								
Machine								
Trucking								
Design								
Pattern								
Gen. Administrative								
TOTAL	$ 52,097	$ 48,201	$3,896	$1,726	$ 702*	$2,872	$ 51,073	94.4
PRODUCTIVE COST CENTERS:								
Yarn Preparation								
Bobbin								
Warp								
Weaving								
Mending								
Bleach								
Dress								
Cutting and Splitting								
Finishing								
Wrap and Label								
Stock Room								
GRAND TOTAL	$144,864	$138,799	$6,065	$5,150	$1,110*	$2,025	$140,824	98.6

* Denotes unfavorable variance.

FIGURE 143. Analysis of Variations by Cost Centers (emphasizing controllable costs)

Responsibility for Overhead Variances. Responsibility for overhead variances starts with the setting of standards and their approval by operating executives. This means that expenses should be accumulated only in terms of individual responsibilities; i.e., only the controllable overhead items are to be shown in the departmental statement. A good example of this is furnished in the case of a textile manufacturer (Figure 143) which represents an analysis of controllable costs by cost centers.

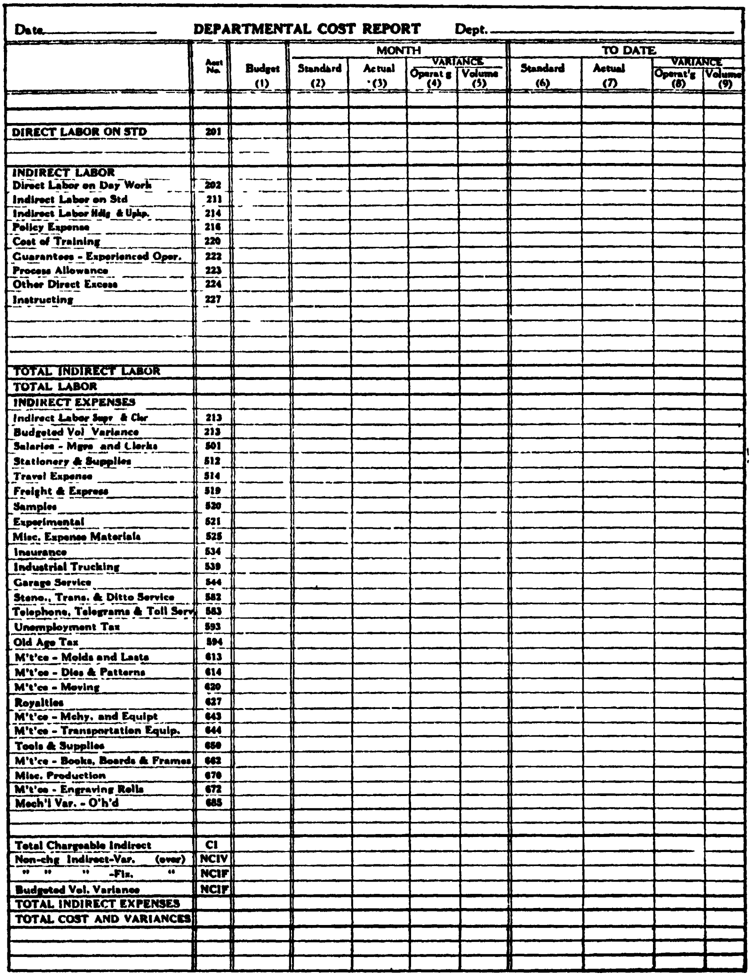
Total departmental costs always include some items which arise from outside the department and which are not controllable by the department executive. The department's share of building costs, depreciation on machinery, expense for heat and power, and in many cases maintenance of buildings and machines are examples of this type of allocated costs. Such items are an integral part of the cost of making products in the department, but their control responsibility lies elsewhere in the organization.

Apportionment of service department expenses in a departmental report serves no useful purpose since the foreman obviously has no control over the amount of the proration. A common practice is to include service department expenses in the superintendent's budget where no proration is necessary. By following this principle, the cost department is never embarrassed by having to justify a particular method of splitting expenses among several cost centers. This does not mean that proration is never practiced or may not be necessary. It may be used in the form of a memo or information item on the departmental report to impress the foreman and higher executives with the *total* cost of operating each department while avoiding confusion as to the degree of responsibility. Secondly, for product cost purposes proration becomes necessary in order to develop proper overhead rates. An excellent example of a departmental report used by a rubber manufacturer and showing service costs for information only is shown in Figure 144.

The face of the report (Figure 144*a*) lists each item of labor and indirect cost considered controllable by the foreman. On the reverse side are shown other items of indirect charges comprising elements of departmental cost not controllable (i.e., "chargeable") within the department. "Nonchargeable Indirect-Variable" items are controllable by the division superintendent. Although allocated to each department by rates, they appear as totals in the reports prepared for divisional superintendents. Similarly, "Nonchargeable Indirect-Fixed" items are allocated from totals reported to and controlled by proper executives.

In column 1 of the report is entered the "budget" or one twelfth of the annual budget allotment for the department. In column 2 is entered the standard cost for each item, derived by multiplying actual units produced by the standard cost per unit. Actual amounts are entered in column 3. From these data operating or efficiency variances and variances due to volume fluctuations are derived and entered in columns 4 and 5, respectively. Segregation of variances into two classes makes possible a clear recognition of causes and enables a foreman to concentrate upon correction of unfavorable variances of an operating nature (column 4).

Daily Overhead Reports. Many plants have found it an absolute necessity to institute daily reports concerning items which must be watched closely in order not to get out of hand. If they are operating



Date__________ DEPARTMENTAL COST REPORT Dept.__________

			MONTH				TO DATE			
					VARIANCE				VARIANCE	
	Acct No.	Budget (1)	Standard (2)	Actual (3)	Operat'g (4)	Volume (5)	Standard (6)	Actual (7)	Operat'g (8)	Volume (9)
DIRECT LABOR ON STD	201									
INDIRECT LABOR										
Direct Labor on Day Work	202									
Indirect Labor on Std	211									
Indirect Labor Hdlg & Upkp.	214									
Policy Expense	216									
Cost of Training	220									
Guarantees - Experienced Oper.	222									
Process Allowance	223									
Other Direct Excess	224									
Instructing	227									
TOTAL INDIRECT LABOR										
TOTAL LABOR										
INDIRECT EXPENSES										
Indirect Labor Supv & Clr	213									
Budgeted Vol Variance	213									
Salaries - Mgrs and Clerks	501									
Stationery & Supplies	512									
Travel Expense	514									
Freight & Express	519									
Samples	520									
Experimental	521									
Misc. Expense Materials	525									
Insurance	534									
Industrial Trucking	539									
Garage Service	544									
Steno., Trans. & Ditto Service	582									
Telephone, Telegrams & Toll Serv	583									
Unemployment Tax	593									
Old Age Tax	594									
M't'ce - Molds and Lasts	613									
M't'ce - Dies & Patterns	614									
M't'ce - Moving	620									
Royalties	627									
M't'ce - Mchy. and Equipt	643									
M't'ce - Transportation Equip.	644									
Tools & Supplies	650									
M't'ce - Books, Boards & Frames	662									
Misc. Production	670									
M't'ce - Engraving Rolls	672									
Mech'l Var. - O'h'd	685									
Total Chargeable Indirect	CI									
Non-chg Indirect-Var. (over)	NCIV									
" " " -Fix. "	NCIF									
Budgeted Vol. Variance	NCIF									
TOTAL INDIRECT EXPENSES										
TOTAL COST AND VARIANCES										

FIGURE 144*a*. Departmental Cost Report (*face*)

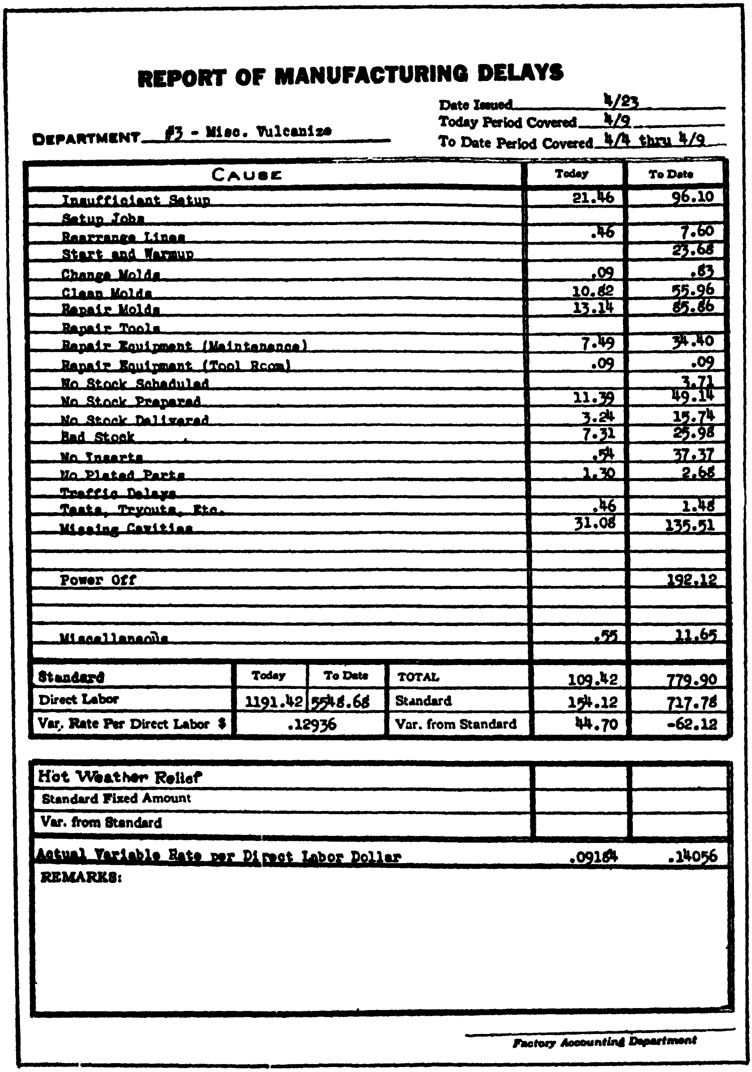
reports they are most likely of the nonpolicy making type and therefore are of chief interest to departmental and divisional operating executives. They are intended to provide them with immediate information in concrete form. One of the most important items that needs daily watching is the idle time cost covering idleness of both men and machines. It is an important measure of the cost of equipment and organization not currently used to capacity. Where external factors cause the idle time variance, they emphasize the need for volume and serve to impress upon management the necessity for more intense sales efforts. Where internal conditions cause the variance, increased manufacturing efficiency

Dept.________________________

			MONTH					TO DATE				
	Acct No.	Budget (1)	Standard (2)	Actual (3)	VARIANCE		Standard (6)	Actual (7)	VARIANCE		
					Operat'g (4)	Volume (5)			Operat'g (8)	Volume (9)	
NON-CHG. INDIRECT-VAR											
Elevators	540										
Electric Power	547										
Steam Power	548										
Gas	550										
Engineering - New Molds	584										
" - Regular	585										
Sock and Forms	612										
New Lasts (Labor and Waste)	615										
Mold Expense	616										
Dies and Patterns Exp	617										
Moving Expense	619										
Machy. and Equip Exp	639										
Transportation Equip. Exp.	645										
Engraving Rolls Exp.	671										
TOTAL NON-CHG IND.-VAR.											
NON-CHG. INDIRECT-FIXED											
Administration	503										
Factory Vacations	523										
Air	551										
Water	553										
Rent Equivalent	556										
Insurance-Factory Vacations	595										
Unemployment Tax-Fact. Vac.	596										
Old Age Tax-Fact Vac	597										
Depreciation - Machinery	608										
" - Molds & Lasts	610										
Rentals	625										
Payroll & Cashier	504										
Accounting	510										
Industrial Relations	528										
Dist of Medical Dept.	530										
Technical Service	531										
Laboratory Service	536										
Service Distribution	555										
Dist Mach. and Process Experiments	557										
General Office Mgr. Service	581										
Standards	586										
Planning & Scheduling	587										
Process Service	624										
TOTAL NON-CHG. IND.-FIX.											

FIGURE 144*b*. Departmental Cost Report (*reverse*)

as a means of lowering costs must be sought. In the latter case, idle capacity is to a large extent the responsibility of the departmental or other operating executive. Figure 145 illustrates an analysis of manufacturing delays by causes. Below the actual figures is a comparison with standard and the variance both for the day and cumulatively. This report is in totals for the department. A more detailed report by ma-



REPORT OF MANUFACTURING DELAYS

Date Issued 4/23
Today Period Covered 4/9
To Date Period Covered 4/4 thru 4/9

DEPARTMENT #3 - Misc. Vulcanize

CAUSE	Today	To Date
Insufficient Setup	21.46	96.10
Setup Jobs		
Rearrange Lines	.46	7.60
Start and Warmup		23.68
Change Molds	.09	.83
Clean Molds	10.82	55.96
Repair Molds	13.14	85.86
Repair Tools		
Repair Equipment (Maintenance)	7.49	34.40
Repair Equipment (Tool Room)	.09	.09
No Stock Scheduled		3.71
No Stock Prepared	11.39	49.14
No Stock Delivered	3.24	15.74
Bad Stock	7.31	25.98
No Inserts	.54	37.37
No Plated Parts	1.30	2.68
Traffic Delays		
Tests, Tryouts, Etc.	.46	1.48
Missing Cavities	31.08	135.51
Power Off		192.12
Miscellaneous	.55	11.65

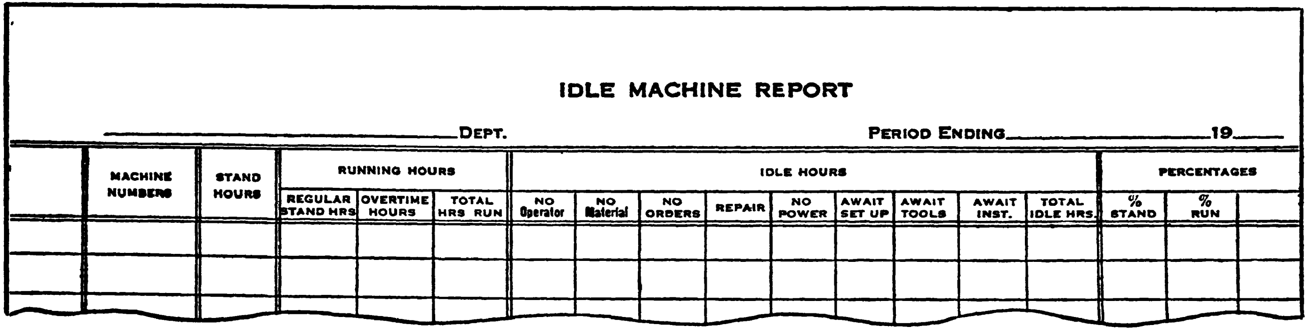
Standard	Today	To Date	TOTAL	109.42	779.90
Direct Labor	1191.42	5548.68	Standard	154.12	717.78
Var. Rate Per Direct Labor $	.12936		Var. from Standard	44.70	-62.12

Hot Weather Relief		
Standard Fixed Amount		
Var. from Standard		
Actual Variable Rate per Direct Labor Dollar	.09184	.14056

REMARKS:

Factory Accounting Department

FIGURE 145. Report of Manufacturing Delays



IDLE MACHINE REPORT

________________DEPT. PERIOD ENDING________________19____

	MACHINE NUMBERS	STAND HOURS	RUNNING HOURS			IDLE HOURS									PERCENTAGES		
			REGULAR STAND HRS	OVERTIME HOURS	TOTAL HRS RUN	NO Operator	NO Material	NO ORDERS	REPAIR	NO POWER	AWAIT SET UP	AWAIT TOOLS	AWAIT INST.	TOTAL IDLE HRS.	% STAND	% RUN	

FIGURE 146. Idle Machine Time Report

chines is shown in Figure 146. A careful study of either Figure 145 or 146 may show that responsibility is often at higher than departmental levels. Possible remedies for purely internal causes may lie in more careful planning, the introduction of machine load charts or planning boards to show work in process or work ahead.

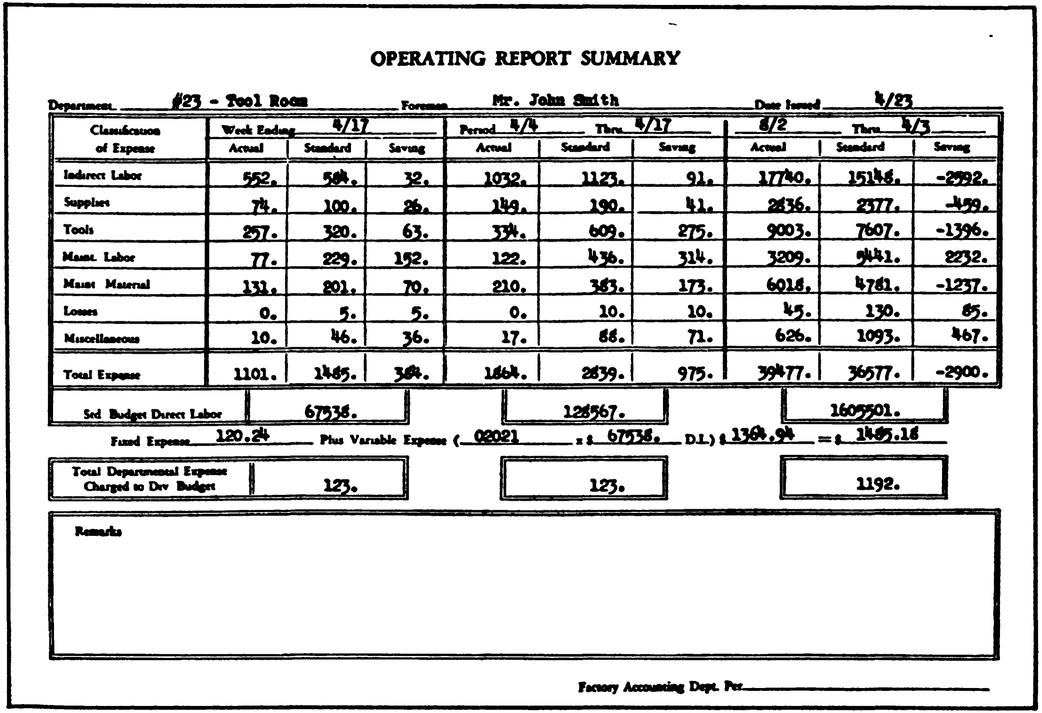
Other daily reports at the departmental level cover daily expense reports to each foreman with a summary of all departments to the superintendent. They are simple in form showing actual and standard, daily and cumulative figures.

Weekly Reports. In general it may be said that most weekly expense reports are summaries of daily reports. An excellent illustration is furnished by Figure 147 which shows a summary of expenses for a week with the usual comparative arrangement. Budget reports are the feature of weekly reports in many plants. Usually a copy of the approved flexible budget is given to the foreman for a week in advance and thus may be used as a control sheet. The actual overhead is entered by the cost department weekly; copies are sent to the foremen and plant superintendent. Cumulative figures are included as a matter of routine. For the superintendent there is a summary of costs and performance of each department, summarized from the daily reports, and showing variances by causes with, if necessary, recommendations.

Monthly Reports. Again, in the case of monthly reports, it is necessary to draw a distinction among the various levels of managerial responsibility. At the departmental level reports are made to foremen or department heads by individual accounts. These reports are in the nature of monthly budget reports and hence reveal actual and allowed costs and plus and minus variances from the budget figures. This information may be shown in total as well as per unit. Frequently the monthly reports may combine production figures and labor costs along with the reporting of expenses.

At the intermediate or divisional level monthly reports to division heads are likely to consist of copies of the departmental reports plus summaries of these covering actual and budgeted expense for the current month and cumulatively for the year to date. Finally, at the top or policy-making level the information furnished is generally in the form of a summary of operating cost variances.

The type of summary reports referred to here is concerned with reports at top level of management. The balance sheet and profit and loss statement with accompanying variance summaries are by now sufficiently familiar. In the case of summary reports, the assignment of responsibility becomes of extreme importance. The chief executive is responsible for the net profit because he is the only one with control over



OPERATING REPORT SUMMARY

Department #23 - Tool Room Foreman Mr. John Smith Date Issued 4/23

Classification of Expense	Week Ending 4/17			Period 4/4 Thru 4/17			8/2 Thru 4/3		
	Actual	Standard	Saving	Actual	Standard	Saving	Actual	Standard	Saving
Indirect Labor	552.	584.	32.	1032.	1123.	91.	17740.	15148.	-2592.
Supplies	74.	100.	26.	149.	190.	41.	2836.	2377.	-459.
Tools	257.	320.	63.	334.	609.	275.	9003.	7607.	-1396.
Maint. Labor	77.	229.	152.	122.	436.	314.	3209.	5441.	2232.
Maint Material	131.	201.	70.	210.	383.	173.	6018.	4781.	-1237.
Losses	0.	5.	5.	0.	10.	10.	45.	130.	85.
Miscellaneous	10.	46.	36.	17.	88.	71.	626.	1093.	467.
Total Expense	1101.	1485.	384.	1864.	2839.	975.	39477.	36577.	-2900.
Std Budget Direct Labor	67538.			128567.			1605501.		

Fixed Expense 120.24 Plus Variable Expense (.02021 x $ 67538. D.L.) $ 1364.94 = $ 1485.18

Total Departmental Expense Charged to Div Budget	123.	123.	1192.

Remarks

Factory Accounting Dept. Per

FIGURE 147. Comparative Weekly Operating Summary

all factors affecting this figure. But tracing the figures back to gross margin there are revealed variances resulting from sales volume, selling price, manufacturing cost, and product mix. All except manufacturing costs are the responsibility of the sales department.

In general, summary reports cover, aside from the financial statements already mentioned, three areas:

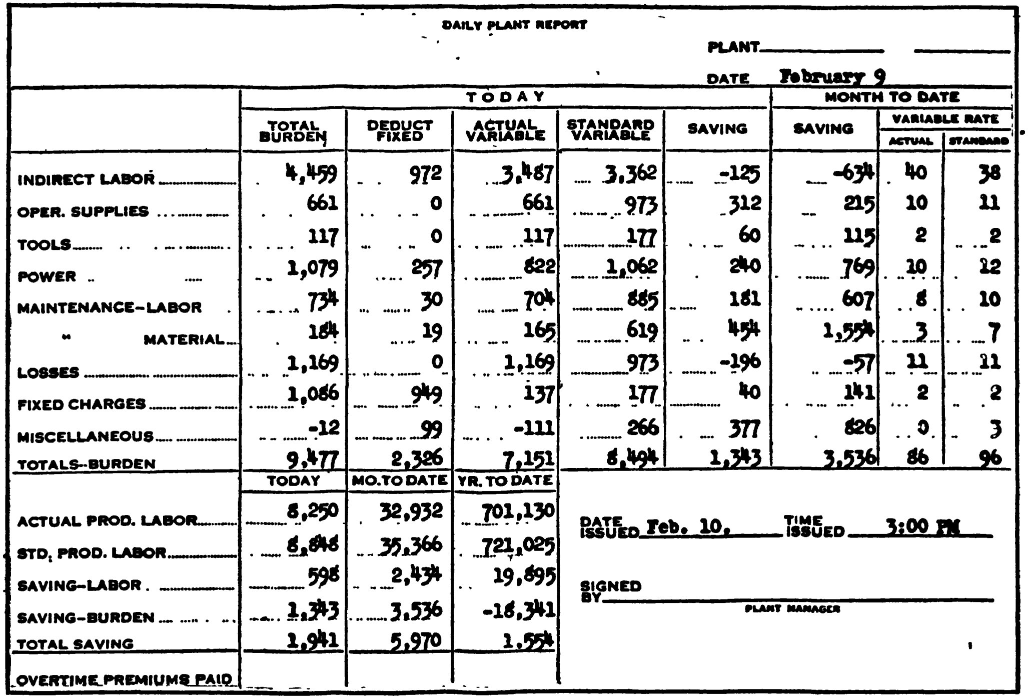
1. Control over operating efficiency
2. Personnel reports
3. Internal-external relationships

Control over operating efficiency is evidenced by summaries of departmental reports mentioned earlier in this chapter in connection with expense and other reports at operating levels. Their purpose is to control, on the one hand, the activities of subordinates and thus attain divisional policies, budgets, and standards, and on the other, to coordinate sales, production, and research.

In addition, top management is concerned with personnel reports, covering turnover and labor relations. Finally, in connection with internal-external relations, summary reports aim at disclosing trends of business, protecting the rate of return, controlling the flow of funds into inventory or plant, and planning for expansion. In the case of the latter, the aim is to disclose particularly the amount and source of future capital requirements.

Daily Summaries. Reports of daily activities cover, on the one hand, financial summaries and, on the other, summaries of plant activities. The daily financial summary includes first of all a cash statement. The latter shows the opening balance, receipts, disbursements, and closing balance. A second item covers information in connection with customers' orders, particularly sales, shipments, and unfilled orders. The final item includes data concerning receivables, payables, and purchase commitments. Particularly important in connection with payables are the amounts required to meet payrolls and other fast maturing liabilities. The whole report is intended to convey a picture of the working capital position of the business including data to show the changes and the possible extent of the changes likely to occur in the working capital.

Daily Plant Reports. Since the summaries considered here are intended for top management, some thought must be given to furnishing the latter with a compact daily picture of plant activities. An excellent illustration of such a report is furnished by Figure 148. By condensing the expense classification it is possible to show daily expenses. After subtracting the fixed charges which are, at the operating level, noncontrollable, the actual variable charges are obtained and compared with the



DAILY PLANT REPORT

PLANT________ ________

DATE February 9

	TODAY					MONTH TO DATE		
	TOTAL BURDEN	DEDUCT FIXED	ACTUAL VARIABLE	STANDARD VARIABLE	SAVING	SAVING	VARIABLE RATE	
							ACTUAL	STANDARD
INDIRECT LABOR	4,459	972	3,487	3,362	-125	-634	40	38
OPER. SUPPLIES	661	0	661	973	312	215	10	11
TOOLS	117	0	117	177	60	115	2	2
POWER	1,079	257	822	1,062	240	769	10	12
MAINTENANCE-LABOR	734	30	704	885	181	607	8	10
" MATERIAL	184	19	165	619	454	1,554	3	7
LOSSES	1,169	0	1,169	973	-196	-57	11	11
FIXED CHARGES	1,086	949	137	177	40	141	2	2
MISCELLANEOUS	-12	99	-111	266	377	826	0	3
TOTALS--BURDEN	9,477	2,326	7,151	8,494	1,343	3,536	86	96

	TODAY	MO. TO DATE	YR. TO DATE
ACTUAL PROD. LABOR	8,250	32,932	701,130
STD. PROD. LABOR	8,848	35,366	721,025
SAVING--LABOR	598	2,434	19,895
SAVING--BURDEN	1,343	3,536	-18,341
TOTAL SAVING	1,941	5,970	1,554
OVERTIME PREMIUMS PAID			

DATE ISSUED Feb. 10, TIME ISSUED 3:00 PM

SIGNED BY________________

PLANT MANAGER

FIGURE 148. Daily Plant Report

standard variables to show loss or gain over standard. A cumulative summary for month to date completes the picture. At the bottom of the report summaries of labor and manufacturing overhead are given for the day, as well as month and year to date.

Weekly Plant Reports. Figure 147, mentioned earlier, is an illustration of how daily figures are assembled to produce weekly summaries. The particular illustration provides comparative figures for several weeks, and while Figure 147 covers the operations of a single department, it can easily be adapted to summarize the activities of the entire plant.

Monthly Summaries. In the case of monthly summaries the process of accumulation of daily and weekly figures is continued. Since the month represents an important calendar division, other matters are reported to top management in addition to the above-mentioned items summarized from weekly reports. These have to do largely with matters affecting long-range policy. First under this heading may be mentioned various forecasts. These cover forecasts of sales for a year or more, revised monthly. Included under this heading may be an analysis of sales trends by products, particularly trends showing the *rate* of increase or decrease. This forecast may be followed by a production forecast outlining the production program by lines, sizes, etc., as well as the production costs, including the budget of manufacturing overhead. Next may logically follow a forecast of inventory position including statistics on important items of the number of months' supply on hand based on production and shipments and number of months' supply required to meet production schedules. It should also show the finished goods on hand, unfilled production schedules, and balance available for sale.

Next in importance is a forecast of personnel required to meet production schedules, suitably analyzed by types and grades of labor. This may be followed by the financial forecast showing working capital requirements and the capital assets program showing additional requirements for space, machinery, and equipment, and also prospective retirements of the latter. All of this information may well be summarized for the top executives to show the relative position of the business in the industry.

To be effective, the forecasts must be followed up through a comparison of budgeted and actual figures. Briefly, the items may result in reports covering the following:

1. Condensed financial and operating statements
2. Sales analyses
3. Production and inventory
4. Departmental operating reports

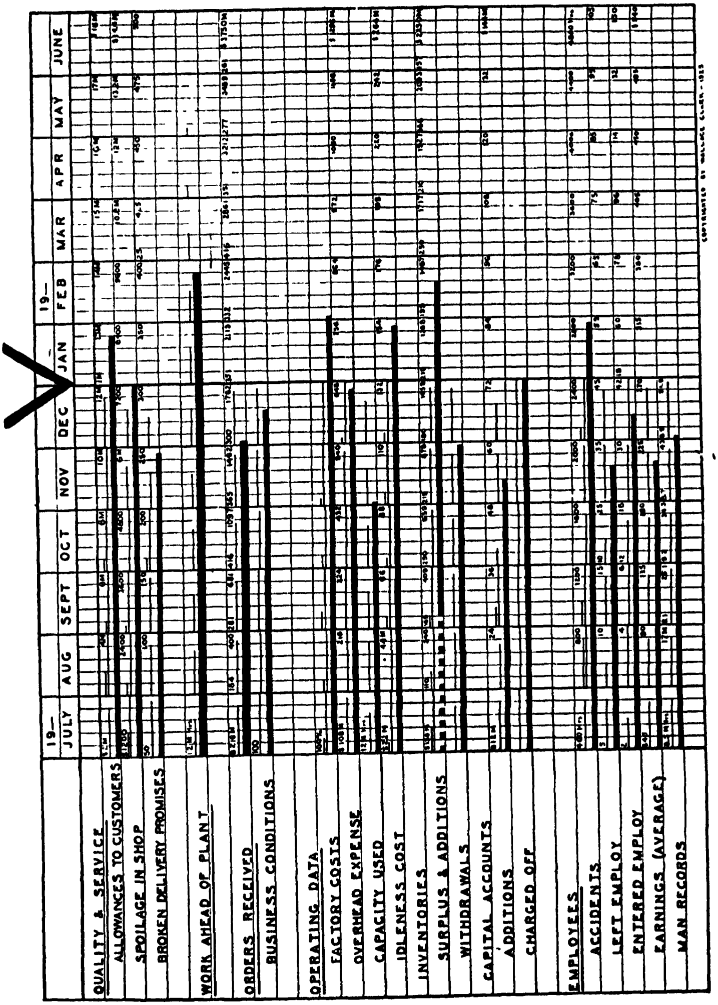


FIGURE 149. Executive Control Chart

Included under the heading of financial and operating statements are the balance sheet and profit and loss statement. They are prepared in condensed form to show financial position and operating results by plants and over-all. Accompanying the operating statement may be a profit analysis featuring a summary of variances.

The sales analyses mentioned above contain quota attainments by divisions and products, current bookings, current billings, and perhaps some industry comparisons. Purely internal items are also reported on. These include sales returns and allowances as well as selling expense analyses.

Production and inventory reports show major deviations from forecasts. The production cost reports and their variances from the budget form part of the operating summary mentioned above. As for the departmental operating reports, these have already been discussed. They take various forms. There is no reason, for example, why Figure 148 could not be adapted to show summaries for individual departments. It could be expanded to show damage reports, labor efficiency, and material usage.

Graphic Executive Control Chart. Figure 149 is an example of a Gantt Progress chart and is an excellent illustration of how a great deal of information can be condensed into a single one-page chart. The light lines and figures represent quotas or standards, the heavy lines actual attainments.

The purpose of graphic reports is to make immediately apparent that a certain result is satisfactory or unsatisfactory. Comparisons presented concern the attitude of mind of customers toward the company as revealed by quality of product and service rendered. They also show what work is ahead in plant; orders received month by month; data concerned with the operation of business, including costs and expenses; idleness; inventories; and finally, pertinent facts regarding the working force such as accidents, labor turnover, earnings, and individual production. For each of these items schedules of standards are developed and actual performance is plotted against these predetermined figures. Reports in this form indicate whether or not progress made is satisfactory or unsatisfactory.

Work ahead, an item by itself, shows what per cent of capacity of the plant is covered by orders. Orders received are plotted against monthly sales quotas. Business conditions are a forecast of general business activity. Operating data include factory costs, overhead, capacity used, idleness cost, inventories, and changes in capital accounts. Reports on employees concern accidents, number left employ, number entered employ, average earnings, and man records made up from a daily production record of each workman compared with a definite standard.

QUESTIONS

1. What role does the principle of exceptions play in internal reports?
2. How is cost analysis related to cost control?
3. Is there any basic difference in reports furnished for different levels of the management hierarchy? Explain.
4. Are internal reports concerned solely with internal events and conditions? Explain.
5. What is the purpose of material usage reports?
   a) Who makes them?
   b) To whom are they addressed?
   c) How often are they made?
6. Are all volume variances noncontrollable? Explain.
7. What function does the budget serve in furthering manufacturing expense control?
8. Should prorated service department expenses be included in reports to foremen?
9. What factors affect tool costs? What reports would you recommend in this connection?
10. What is the relation between summary and detailed operating statements?
11. Should scrap and spoilage be reported by:
    a) Individual workers?
    b) Departmental responsibilities?
    c) Types of scrap?
12. What kind of reports may be used to control maintenance of buildings and equipment?

Chapter 24

DISTRIBUTION COSTS

Nature and Significance of Distribution Costs. The accounting for distribution cost concerns itself with those costs incurred after the goods have been finished and until the goods have been placed in the hands of the customer. In the usual profit and loss statement, distribution costs cover all costs listed after gross profit, including therefore the selling, administrative, and financial management expenses of the business.

Examination of the literature of cost accounting shows that the portion dealing with distribution costs is dwarfed by the large volume of material available in cost accounting for manufacturing and the refinements which have been worked out in this area. Nevertheless, wherever analyses of distribution costs have been made, the results have been as dramatic as those produced by manufacturing cost analyses. To illustrate:

1. An analysis of sales by distributors of mill supplies indicated 44% of orders received were under $5 each, and accounted for only 4% of sales, while 56% of the orders received were over $5 and accounted for 96% of the volume. The need for distributors performing an essential marketing function in this case was apparent when it was further developed that if the manufacturer handled the sales directly, prices would have had to be increased 16 to 21%.
2. A lubricating material manufacturer after 45 years of sales direct to the consumer changed to marketing through a distributor and cut selling costs 50% thus permitting a substantial price cut and higher profits.

Manufacturing Cost vs. Distribution Cost. The techniques developed for distribution cost accounting are borrowed from cost accounting for manufacturing despite the fact that there are some inherent differences in these two areas of cost accounting:

1. Manufacturing cost accounting concerns itself with costs by departments, cost centers, processes, and units of product, while distribution cost accounting deals with cost by sales territories, customers, salesmen, products, and size of orders.

2. The costs incurred in the manufacturing process are costs in and about a specific place—a plant—the operating conditions of which are subject to a great degree of control. The marketing process permits only a limited degree of control; first, because the customer, his wishes, and peculiarities are frequently the governing factor; and, secondly, because a great part of the selling function is carried on away from the office.
3. Manufacturing efficiency is generally measured in terms of decreasing unit costs. Selling efficiency is usually measured in increased sales volume as an indication of increased profitability, the latter all too frequently misleading.
4. The comparatively wide use of standards for manufacturing cost is in sharp contrast to the extremely limited development of standards for distribution costs.

Classification of Distribution Costs

The cost accountant should start with the natural classification and proceed to study these items under conditions of increasing or decreasing productive activity. He also examines these items with a view toward the best possible basis for charging the overhead to a specific product or process. From this study follow the steps of manufacturing overhead assembly, allocation, distribution, and final application to the product. The same approach is taken in the analysis of distribution costs.

Direct vs. Indirect Costs. Direct costs are those distribution costs incurred for and benefiting a single segment of sales and can therefore be easily associated with specific commodities, customers, or other sales components. · Accordingly, the cost to operate a district sales office is a direct cost of the sales territory in which the office is located. Indirect costs are those incurred for and benefiting sales generally but which cannot be traced to specific products, customers or other functional units. For example, the salary of the general sales manager is an indirect cost; in fact, the great bulk of distribution costs is indirect in nature.

Fixed vs. Variable. Fixed costs are those distribution costs which do not change in total amount with changes in sales volume. Variable costs do change in total amount as sales volume varies. Again, as in manufacturing cost accounting, the distribution is not a hard and fast one but must depend on conditions in the particular business. For example, a company may own the trucks used to deliver its goods; hence changes in sales volume have little effect on the cost of delivery unless some chauffeurs are dismissed or additional ones hired. Delivery expense can be a variable expense when a company contracts for all its shipping with an outside delivery organization on a ton-mile basis. It should be noted that most costs are fixed for a given range of sales volume and become variable when substantial changes in volume occur. The cost of key personnel, rent, depreciation, taxes, and insurance incurred to operate a branch may be considered fixed, but if volume declines and the branch is closed, the entire expense is variable. During a relatively short period of sales decline, most distribution costs remain fixed but if a depression of long duration is expected, costs will be cut and become variable.

Bases of Classification. Distribution expenses, like production costs, are commonly classified on the following bases:

1. By nature of cost item or object of expenditure, usually referred to as the primary account basis
2. By functions performed, commonly called functional basis
3. By manner of application, i.e., by product group, method of sale or delivery, or sales territory

Primary Expense Classification. The primary expense classification considers all expenses according to the objects of expenditure. The latter include salaries and wages, office supplies, depreciation, insurance, property taxes, and similar items applicable to the distribution function. The number of accounts depends on the extent and detail of the information desired by management.

Primary expense classifications may be developed in two ways. They may be:

1. Laid out without regard for the functional divisions; all primary classes involve all functions and are organized in one all-inclusive list. The functional breakdown is prepared later.
2. Developed as subdivisions of functional classifications.

An illustration of a classification by primary accounts is given below. It represents the commercial expense classification from the Uniform Accounting Manual for the Rubber Manufacturing Industry.

COMMERCIAL EXPENSE CLASSIFICATION—RUBBER MANUFACTURING INDUSTRY

.10 Salaries, Wages, and Commissions (employee compensation)
  .101 Salaries
  .102 Wages
  .103 Commissions and Additional Compensation
.11 Commissions—Agents, Brokers, Dealers
  .111 Agents
  .112 Brokers
  .113 Dealers' Warehouse

- .12 Traveling and Entertainment Expense
- .13 Rent
  - .131 Space Rental
  - .132 Office Equipment Rental
  - .133 Amortization of Leasehold Improvements
  - .134 Losses on Leases
- .14 Maintenance and Repairs
- .15 Taxes
  - .151 Taxes on Real Estate
  - .152 Taxes on Personal Property
    - .1521 Furniture and Fixtures
    - .1522 Merchandise
    - .1523 Intangibles (money and credit)
  - .153 Taxes on Automobiles and Trucks
  - .154 Old Age Benefit Tax
  - .155 Unemployment Insurance Tax
  - .156 Capital Stock Tax (federal)
  - .157 State Franchise or Income Taxes
- .16 Insurance
  - .161 Insurance on Real Estate
    - .1611 Buildings and Appurtenances
    - .1612 Public Liability
    - .1613 Elevator
    - .1614 Riot and Civil Commotion
    - .1615 Pressure Vessel Explosion
  - .162 Insurance on Personal Property
    - .1621 Furniture and Fixtures
    - .1622 Merchandise
    - .1623 Other:
      - .16231 Receivables
      - .16232 Use and Occupancy
      - .16233 Marine
      - .16234 War Risk
      - .16235 Pressure Vessel Explosion
      - .16236 Riot and Civil Commotion
  - .163 Insurance on Automobiles and Trucks
  - .164 Employees' Compensation Insurance
  - .165 Premium on Surety Bonds
  - .166 Life Insurance Executives
  - .167 Employee Group Insurance
  - .168 Losses Not Covered by Insurance
- .17 Depreciation
  - .171 Depreciation and Obsolescence on Buildings and Appurtenances
  - .172 Depreciation of Furniture, Fixtures, and Equipment
  - .173 Depreciation of Automobiles and Trucks

.18 Heat, Light, Power, and Water (portions applicable to commercial expense department)
    .181 Heat
    .182 Light
    .183 Power
    .184 Water
.19 Expense Materials and Supplies
    .191 Packing Supplies
    .192 Shipping Supplies
    .193 Stationery and Office Supplies
    .194 Gasoline and Oil
    .195 Tires and Accessories
    .196 Miscellaneous Supplies
.20 Samples
.21 Losses on Finished Goods
    .211 Breakage
    .212 Merchandise Sold as Scrap
    .213 Inventory Differences
.22 Communications
    .221 Telephone
    .222 Telegraph
    .223 Teletype
.23 Postage
.24 Freight, Express, and Parcel Post (other than finished goods)
.25 Books and Periodicals
.26 Dues
.27 Donations
.28 Provisions for Pensions
.29 Provisions for Bad Debts
.30 Advertising
    .301 Advertising Space
        Newspapers
        Magazines
        Posters
        Outdoor Signs
        Electric Signs
    .302 Advertising Agency Service
    .303 Art Work Service (outside)
    .304 Radio
    .305 Display
    .306 Motion Pictures
    .307 Electros
.31 Commercial Research Bureau (outside)
.32 Credit and Collection Agencies
.33 Legal Service (outside)
.34 Patent Expense (outside)

.35 Trucking Service (outside)
.36 Auditing (outside)
.40 Directors' Fees and Expenses
.41 Conventions and Conferences
    .411 Customer Conventions
    .412 Company Conferences
.42 Company Publications
.43 Miscellaneous Unclassified

Though the above classification includes administrative and marketing expenses, this does not mean that these are combined for accounting and report purposes. Because many primary accounts found in the administrative division also exist in the distribution division, a single list of primary accounts has been developed to cover both divisions. By use of code numbers the major expense division can be indicated. Thus, under the method of coding used in the rubber industry, account 85.101 is used to record the salaries of the sales function and account 86.101 the salaries of the administrative function.

Functional Classification of Distribution Costs. Somewhat comparable to departmental classifications used in connection with production costs is the functional basis for classifying distribution costs. The classification is illustrated below.

FUNCTIONAL CLASSIFICATION OF DISTRIBUTION COSTS[1]

1. Investment in finished goods:
    Taxes on stock
    Insurance on stock
2. Storage of finished goods (portions of following expenses applying to factory, branch, and district warehouses):
    Rental expense, or
    Maintenance and repairs to buildings
    Taxes on buildings
    Insurance on buildings
    Depreciation on buildings
    Heat, light, and power
    Outside storage space
3. Inventory control, finished goods:
    Salaries—stock-record clerks
    Salaries—merchandise distribution (allocation of stock to district and branch warehouses and preparation of orders on factory)
    Overhead—space, equipment, supplies, and supervision charges
4. Order assembly (physical handling):
    Salaries—warehouse labor
    Overhead—space, equipment, supplies, and supervision charges

---

[1] Derived from United States Department of Commerce, *Distribution Cost Analysis.*

5. Packing and shipping:
    - Material
    - Labor
    - Overhead
6. Transportation (on merchandise shipped from factory or branch to customer and from branch to branch, and on returned goods):
    - Freight
    - Truck
    - Express
    - Parcel Post
    - Transportation on consigned merchandise, factory to branch
7. Sales solicitation (Special commodity or customer subdepartments or subfunctions will be set up according to the operating organization of the company, each with the following primary expense accounts):
    - Salaries—salesmen
    - Commissions—salesmen
    - Commissions—agents
    - Commissions—brokers
    - Traveling expense—salesmen
    - Entertainment—salesmen

   Overhead (Except for the second account below, these overhead accounts would not, of course, be set up by commodity or customer subdepartments):
    - Salaries—sales executives
    - Salaries—merchandise-department managers
    - Salaries—district and branch managers
    - Sales employment and personnel
    - Sales training
    - Sales research
    - Sales engineering service
    - Adjustment
    - Sales records
    - Space and equipment charges
8. Advertising:
    - Advertising Space
        - Newspapers
        - Magazines
        - Posters
        - Outdoor signs
        - Electric signs
    - Advertising agency services
    - Art work—outside
    - Radio
    - Television
    - Displays
    - Motion Pictures
    - Electros

Overhead:
  Salaries—advertising managers and assistants
  Advertising expenses
  Space and equipment charges

9. Order entry:
   - Salaries—clerical (allocated portion)
   - Overhead—space, equipment, supplies, and supervision charges
10. Credit extension:
    - Salaries—clerical (allocated portion)
    - Overhead—space, equipment, supplies, and supervision charges
11. Billing:
    - Salaries—clerical (allocated portion)
    - Overhead—space, equipment, supplies, and supervision charges
12. Accounts receivable:
    - Salaries—clerical (allocated portion)
    - Overhead—space, equipment, supplies, and supervision charges

Classification by Manner of Application. The application of distribution costs varies with the nature of the analysis sought. In manufacturing accounting various overhead rates are applied to the product. Distribution costs may be applied to product, sales territories, customers, method of distribution, salesmen, etc. Figure 150 illustrates the bases which may be used, following the functional classification of expenses suggested above.

A further illustration of application of distribution costs referred to as the unit functional analysis uses the term *factor of variability* to refer to the bases adopted for the application of distribution costs. The steps necessary to accomplish this result are:

1. Determine how the costs are to be accumulated: by territories, method of sale, products, customers, all four, or any combination of the four.
2. Analyze all distribution costs by functions; collect separately the costs of the functions of marketing.
3. Determine the functional factors of variability, the units of activity with which the amounts of the several functional costs vary.
4. Develop a unit cost for each of the functional factors of variability.
5. Determine the number of functional units required to serve the particular factor of distribution (territory, product, method of sale, or customer) to be costed.
6. Determine the cost of distribution for each factor by applying the information gained through the preceding steps.

Note that under this method all costs are first allocated or charged to specific functions and that a unit rate is developed for each function in terms of that function's factor of variability, that is, its costing unit. In the case of warehousing, the factor of variability (Figure 151) is weight and this same factor is used in developing a warehousing cost per hundredweight for use in various types of analysis, such as by territories, products, or customer classes. On the other hand, traveling expenses are applied to territories on a per-mile basis, and to products and customers on a per-call basis. Under this procedure, classification of costs by functions is of primary importance, and the problem of distinguishing between direct and indirect costs is one of determining whether costs are direct with respect to the function or are indirect and need to be prorated over the various functions. Once total functional costs are determined, their application to territories, products, or customer classes is on a unit functional cost basis, using the functional factor of variability which appears most appropriate.

Functional Cost Groups	Bases of Allocation	
	To Commodities	To Customers
1. Investment in finished goods	Average inventory value	(Not allocated)
2. Storage of finished goods	Floor space occupied	(Not allocated)
3. Inventory control, finished goods	Number of invoice lines	(Not allocated)
4. Order assembly (handling)	Number of standard handling units	Number of invoice lines
5. Packing and shipping	Weight or number of shipping units	Weight or number of shipping units
6. Transportation	Weight or number of shipping units	Weight or number of shipping units
7. Selling	Time studies	Number of sales calls
8. Advertising	Cost of space of specific product advertising	Cost of space of specific customer advertising
9. Order entry	Number of invoice lines	Number of orders
10. Billing	Number of invoice lines	Number of invoice lines
11. Credit extension	(Not allocated)	Average amount outstanding
12. Accounts receivable	(Not allocated)	Number of invoices posted

FIGURE 150. Bases of Allocation to Commodities and Customers

Distribution Cost Systems. Distribution cost accounting is for the most part not really accounting but rather statistical in nature. That is, most attempts at accumulating and analyzing distribution cost are carried on independently of the books of account. Distribution cost systems can be classified into the two broad groups. The actual or historical in which actual distribution costs, once determined, are allocated to products, territories, and channels of distribution, and the standard type wherein predetermined distribution costs, generally tied to a system of budgetary control, form the basis for recording these costs and their ultimate comparison with actual costs for the purposes of control.

DISTRIBUTION EXPENSE BUDGET AND APPORTIONMENT

Month of April, 19—

Function	Factor of Variability	Total Expense	No. of Units	Unit Cost	Territory No. 1		Territory No. 2		Warehouse	
					No. of Units	Total	No. of Units	Total	No. of Units	Total
1. Warehousing	Cwt.	$ 958.40	47,920	$ .02	20,400	$ 408.00	13,500	$ 270 00	14,020	$ 280.40
2. Selling:										
3. Salaries	Calls	2,125.00	1,700	1.25	1,000	1,250.00	700	875.00		
4. Traveling	Miles	1,050.00	21,000	.05	12,000	600.00	9,000	450.00		
5. Variable Administration	Calls	425.00	1,700	.25	1,000	250.00	700	175.00		
6. Advertising:										
7. Direct Mail	Pieces	2,000.00	20,000	.10	10,000	1,000 00	7,000	700.00	3,000	300.00
8. Publication	Sales Value (Warehouse)	148.00								148.00
9. Dealers' Helps	Pieces	1,300.00	2,600	.50	1,400	700.00	800	400.00	400	200.00
10. Receive and Route Orders	Orders	290.00	2,900	.10	1,700	170.00	1,200	120.00		
11. Take Order	Orders	53.00	1,060	.05						
12. Deliver	Cwt.	1,356.00	33,900	.04	20,400	816.00	13,500	540.00	1,060	53.00
13. Load	Cwt.	140.20	14,020	.01					14,020	140.20
14. Bill	Lines Billed	178.50	5,950	.03	2,400	72.00	1,900	57.00	1,650	49.50
15. Collect	Remittances	100.40	2,510	.04	1,000	40.00	800	32.00	710	28.40
16. Fixed Administration	Time Spent	1,424.50				650.00		350.00		424.50
		$11,969.00				$6,196.00		$4,149.00		$1,624.00

Figure 151. Functional Analysis of Distribution Costs Related to Factor of Variability

EXPENSE DISTRIBUTION SHEET

Costs	Total	Sales Service Departments			
		Order Assembly	Packing and Shipping	Trans-portation	Selling General
	$	$	$	$	$
Salaries	50,000	1,000	1,200	2,000	4,000
Commissions	10,000				
Compensation to Agents and Brokers	8,000				
Traveling and Entertainment	4,000				500
Rent	6,000	2,000	950	600	200
Maintenance and Repairs	800	200	95	260	20
Taxes—Real Estate	400				
Taxes—Personal Property	300	10	10	100	
Taxes—Old Age Benefits	500	10	12	20	40
Taxes—Unemployment Insurance	1,500	30	36	60	120
Taxes—State Franchise or Income	1,000				
Insurance—Real Estate	90				
Insurance—Furniture and Fixtures	60	2	2	20	1
Insurance—Merchandise	100	30			
Insurance—Autos and Trucks	100			25	
Depreciation—Buildings	170				
Depreciation—Furniture and Fixtures	120	4	4	40	2
Depreciation—Autos and Trucks	400			100	
Heat	350	100	45	30	10
Light	180	30	20	5	5
Power	20		2	18	
Packing Supplies	1,500		1,500		
Shipping Supplies	350		350		
Stationery and Office Supplies	275	10	10	20	10
Gasoline and Oil	590			100	
Tires and Accessories	150			20	
Samples	1,100				150
Telephone	450	5	5	10	100
Telegraph	80				20
Postage	550				80
Books and Periodicals	20				10
Dues	100				
Provision for Pensions	400				150
Provision for Bad Debts	200				
Advertising					
Advertising Space	10,000				
Advertising Agency Service	1,000				
Art Work Service	1,500				
Radio and Television	4,000				
Displays	1,000				
Electros	850				
Credit and Collection Service	200				
Legal Service	350				
Auditing Service	300				
Conventions and Conferences	500				150
Totals	109,555	3,431	4,241	3,428	5,568
Order Assembly (Number of Invoice Lines)		3,431			
Packing and Shipping (Weight or Number of Shipping Units)			4,241		
Transportation (Direct or Weight or Number of Shipping Units or Ton Miles)				3,428	
Selling, General (Number of Salesmen)					5,568
Advertising (Time Reports)					
Order Entry (Number of Orders)					
Billing (Number of Invoice Lines)					
Credit Extension (Average Amount Outstanding)					
Accounts Receivable (Number of Invoices Posted)					
Administration, General (Special Rate)					
	109,555				

FIGURE 152. Expense

FOR DISTRIBUTION COSTS - MONTH OF JANUARY, 19—

Sales Service Departments					Administration General	Terr. I	Terr. II	Terr. III
Advertising	Order Entry	Billing	Credit Extension	Accounts Receivable				
$	$	$	$	$	$	$	$	$
2,900	400	900	1,200	400	2,000	14,000	9,500	10,500
						3,000	4,500	2,500
						2,000	2,000	4,000
300						1,300	900	1,000
200	100	100	50	100	100	700	900	
20	10	10	5	10	10	40	50	70
								400
10	5	5	10	10	15	50	30	45
29	4	9	12	4	20	140	95	105
87	12	27	36	12	60	420	285	315
					470	180	150	200
								90
2	1	1	2	2	3	10	6	8
						25	25	20
						20	20	35
								170
4	2	2	4	4	6	20	12	16
						80	80	140
10	5	5	3	5	5	35	45	52
5	3	4	4	4	5	35	30	30
20	20	100	10	10	5	25	20	15
						200	140	150
						45	50	35
						300	350	300
100	5	5	30	5	30	50	55	50
						20	20	20
200		200	20			15	15	20
10								
					100			
75					175			
			200					
3,000						3,000	2,000	2,000
600						200	200	
200						300	400	600
4,000								
						400	300	300
						200	300	350
			200					
					350			
					300			
75					275			
11,847	567	1,368	1,786	566	3,929	26,810	22,478	23,536
						857.75	1,029.30	1,543.95
						1,272.30	1,272.30	1,696.40
						1,371.20	1,199.80	857.00
						2,436.00	1,392.00	1,740.00
11,847						3,554.10	3,554.10	4,738.80
	567					170.10	141.75	255.15
		1,368				615.60	478.80	273.60
			1,786			893.00	357.20	535.80
				566		169.80	141.50	254.70
					3,929	1,375.15	1,375.15	1,178.70
						39,525.00	33,419.90	36,610.10

Actual Cost Systems

Analysis by Territories. Analysis by territories begins with a list of expense accounts and total expenses incurred for a particular period as revealed by the subsidiary ledgers for selling and administrative expenses (shown at the left of Figure 152). The problem is one of applying these expenses to functional groups, equivalent to the allocation of manufacturing overhead to producing and service departments in cost accounts for manufacturing. In this instance the sales service departments and administration are equivalent to the manufacturing service departments and the territories similar to producing departments in the plant.

Some of the bases used to accomplish such allocations are:

1. Summary of distribution analysis sheets
2. Value of fixed assets
3. Meter measurement
4. Direct charges to territories

The salary allocation is derived from the salary distribution sheet for selling and administrative salaries. Commissions are shown as direct territorial charges since they reflect a particular volume of business done in a specific territory. Insurance and depreciation are allocated on the basis of fixed asset value, while light, power, and heat are best allocated by use of meter measurement.

Distribution to Territories. The next step requires the distribution of what are in effect service department expenses to the territories. The bases used, as illustrated in Figure 152, are as follows:

Function	*Basis of Distribution to Territories*
Order Assembly	Number of invoice lines
Packing and Shipping	Weight or number of shipping units
Transportation	Direct or weight or number of shipping units or ton miles
Selling, General	Number of salesmen
Advertising	Time reports
Order Entry	Number of orders
Billing	Number of invoice lines
Credit Extension	Average amount outstanding
Accounts Receivable	Number of invoices posted
Administration, General	Special rate

The final columns indicate the total distribution costs applied to the three territories. Assuming that sales records have been kept on a territorial basis, it is possible to produce a profit and loss statement showing the results of operations in each of the three territories as shown in Figure 153.

PROFIT AND LOSS STATEMENT

FOR THE MONTH ENDED JANUARY 31, 19—

	Terr. I	Terr. II	Terr. III	Total
Sales	$200,000.00	$170,000.00	$160,000.00	$530,000.00
Cost of Sales	148,000.00	122,000.00	125,000.00	395,000.00
Gross Profit	$ 52,000.00	$ 48,000.00	$ 35,000.00	$135,000.00
Distribution Expense	39,525.00	33,419.90	36,610.10	109,555.00
Net Profit or (Loss)	$ 12,475.00	$ 14,580.10	($ 1,610.10)	$ 25,455.00

FIGURE 153. Statement of Profit and Loss by Territories

If the information yielded by this analysis were to be incorporated into the ledger accounts the following journal entries would be required:

(1)

Order Assembly	$ 3,431.00	
Packing and Shipping	4,241.00	
Transportation	3,428.00	
Selling, General	5,568.00	
Advertising	11,847.00	
Order Entry	567.00	
Billing	1,368.00	
Credit Extension	1,786.00	
Accounts Receivable Expense	566.00	
Administration, General	3,929.00	
Territory I, Expense	26,810.00	
Territory II, Expense	22,478.00	
Territory III, Expense	23,536.00	
Selling and Administrative Expense Control		$109,555.00

To allocate selling and administrative expenses to functions and direct expense to territories.

(2)

Expense Territory I	$ 12,715.00	
Expense Territory II	10,941.90	
Expense Territory III	13,074.10	
Order Assembly		$ 3,431.00
Packing and Shipping		4,241.00
Transportation		3,428.00
Selling, General		5,568.00
Advertising		11,847.00
Order Entry		567.00
Billing		1,368.00
Credit Extension		1,786.00
Accounts Receivable Expense		566.00
Administration, General		3,929.00

To distribute service function expenses to territories.

(3)

Sales	$530,000.00	
Profit and Loss Territory I		$200,000.00
Profit and Loss Territory II		170,000.00
Profit and Loss Territory III		160,000.00

To close sales to territorial profit and loss accounts.

(4)

Profit and Loss Territory I	$148,000.00	
Profit and Loss Territory II	122,000.00	
Profit and Loss Territory III	125,000.00	
Cost of Sales		$395,000.00

To close cost of sales to territorial profit and loss.

(5)

Profit and Loss Territory I	$ 39,525.00	
Profit and Loss Territory II	33,419.90	
Profit and Loss Territory III	36,610.10	
Expense Territory I		$ 39,525.00
Expense Territory II		33,419.90
Expense Territory III		36,610.10

To close territorial selling and administrative expense to territorial profit and loss accounts.

(6)

Profit and Loss Territory I	$ 12,475.00	
Profit and Loss Territory II	14,580.10	
Profit and Loss Territory III		$ 1,610.10
Profit and Loss, General		25,445.00

To close territorial profit and loss accounts to general profit and loss.

Practical Applications of Territorial Analyses.[2] An example of how a manufacturer of consumer goods has succeeded in reducing the ratio of distribution cost to total sales by use of a territorial analysis is given in Figure 154 which presents the functional cost group used as well as the bases for allocating these costs to territories. Though this manufacturer operates some thirty-seven territories, the operating results for only six of the territories are presented in Figure 155. The extent to which this company separates its functions is worth noting. The use of three-month test periods for determining allocation of such functional costs as transportation to wholesalers and samples is illustrative of a practical technique where detailed records are not kept. The wide range in net profit percentage for the few territories listed in Figure 155 will aid management in focusing attention on the low profit producing territories.

Another application of the technique of territorial analysis is developed by another manufacturer in attempting to measure actual sales against sales potential, thus permitting a concentration of effort on sales "soft spots." This resulted in an increase of 366% in sales and a 45% reduction in marketing costs. The basic assumption in this company's approach is that ability of a salesman to sell a share of the total volume varies with the sales potential of his territory and that as the company as a whole moves ahead saleswise, each salesman should at least increase his own sales at the company rate of gain.

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[2] Most of the illustrations used in the balance of this chapter were derived from United States Department of Commerce Bulletin, *How Manufacturers Reduce Their Distribution Costs.*

Functional Costs	Basis of Allocation to Territories
1. Transportation—factory to branches	Number of items shipped.
2. Transportation—to wholesalers	Analysis of actual freight bills for a 3-month test period.
3. Shipping from factory .	Number of items shipped multiplied by shipping time per item.
4. Shipping from branches .	Do.
5. Billing	Number of invoice lines.
6. Loss on returned goods . .	Direct.
7. Salesmen's salaries and travel expenses	Do.
8. Sales personnel expenses: Auto insurance and depreciation, social security, premiums and insurance.	Average number of salesmen.
9. District manager's salary and expenses	Direct or average number of salesmen.
10. Sales manager's salary and expenses	Average number of salesmen.
11. Salesmen's training . .	Do.
12. Routing and scheduling of salesmen	Do.
13. Samples and transportation costs on same .	Analysis of actual number of samples sent to each area for a 3-month test period.
14. Circulars and advertising literature to wholesalers and retailers.	Analysis of actual number of each item sent to each area for test period.
15. Broadside printing for wholesalers	Direct to trading area where wholesaler is located.
16. Retail store signs . .	Number of signs sent to each area.
17. Direct mail advertising to consumers	Analysis of actual number mailed to each area.
18. Quotation department	Number of price-change letters sent to each area (to both salesmen and wholesalers).
19. National advertising media	Circulation by States for each media: Where State is in 2 areas, divided on basis of proportionate number of retail outlets in each area.
20. Advertising overhead	Total advertising expenses allocated to each area (items 14, 15, 16, 17, and 19).
21. Tabulating department . . .	Number of invoice lines.
22. Records department .. .	Average number of salesmen.
23. Marketing overhead	Total other expenses allocated to area.
24. Product research	Sales.
25. General administration . . .	Do.

FIGURE 154. Functional Classification of Expenses and Bases of Allocation to Territories

Item	Zone No.					
	1	2	3	4	5	6
Net sales	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Cost of sales	60.75	59.44	61.04	57.89	62.28	71.04
Gross profit	39.25	40.56	38.96	42.11	37.72	28.96
Shipping, branch house expense, transportation to branches, transportation to wholesalers, order service	5.48	6.03	6.11	5.04	4.23	3.02
Loss on returned goods	.60	.66	1.26	.58	.23	.34
Representatives' salary, representatives' expense, representatives' moving expense	8.30	7.40	7.61	6.26	6.66	5.10
Personnel expense allowance, auto insurance and depreciation, social security, pensions, and insurance	1.12	.92	1.04	.91	.86	.72
Dist. managers' salary and expense, executive salary and expense	1.20	1.19	1.26	1.10	1.02	.80
Marketing expense	4.94	3.81	4.45	4.30	4.49	3.43
Total marketing expense	21.64	20.01	21.73	18.19	17.49	13.41
Trading profit	17.61	20.55	17.23	23.92	20.23	15.55
Administrative and scientific research expense	8.63	8.63	8.63	8.63	8.63	8.63
Operating profit	8.98	11.92	8.60	15.29	11.60	6.92

FIGURE 155. Profit-and-Loss Statement for 6 Zones, 19—

A performance index is derived by comparing the desired potential in a territory with the actual sales. To illustrate just a portion of this company's territories:

	Territory			Total
	A	B	C	Company
1. Sales goal in each territory	$100,000	$50,000	$30,000	$1,000,000
2. Per cent of company total	10%	5%	3%	100%
3. Actual volume	$ 75,000	$60,000	$15,000	$ 900,000
4. Index of sales performance (3 ÷ 1)	75%	120%	50%	90%

By increasing marketing effectiveness in those areas where sales fell below the goal set, an over-all reduction in distribution cost was accomplished.

Other Methods of Analysis. The technique developed for accounting and analysis of distribution cost by territories can be applied to analyses by salesmen, by commodities, by channels of distribution, by customers, by size of order, and by relative profit margin.

For each type of analysis, other than by salesmen, the first step is the derivation of the functional cost group. This is followed by a choice of bases of allocation, which as previously indicated will vary with the particular type of analysis sought. With regard to the analysis by salesmen, the bases of allocation used are refinements of those developed for territorial analysis. Accordingly, if but one salesman operates in a territory, the analysis is identical with territorial analysis. Where more than one salesman operates in a territory the territorial distribution costs are further analyzed by salesmen.

Analysis by Salesmen. Another method of studying distribution costs is through an analysis of sales and costs by salesmen. The analysis includes the following for each salesman:

1. Actual sales
2. Salary and traveling expense
3. Other distribution expenses allocable to sales credited to the salesman
4. Gross profit
5. Net profit
6. Sales potential for the salesmen equal to the sales goal assigned to the salesman

The results of this analysis are shown in Figure 156. The significant conclusion from this illustration is that sales volume alone is not a reliable indicator of the proficiency of a salesman. Salesman F produced the highest volume of all, an amount equal to 140% of his quota. Nev-

Salesmen (Col. 1)	Shipments (Col. 2)	Per Cent of Quota (Col. 3)	Salary and Commission (Col. 4)	Travel Expenses (Col. 5)	Cost of Handling (Col. 6)	Total Cost (4+5+6) (Col. 7)	Gross Profits (Col. 8)	Net Profit (8—7) (Col. 9)	Net Profit, Per Cent of Sales (9÷2) (Col. 10)	Shipments, Per Cent of Total (Col. 11)	Potential, Per Cent of Total (Col. 12)
A	$26,000	80	$2,000	$3,000	$2,340	$ 7,340	$ 7,540	$ 200	0.8	6.7	9.0
B	26,000	122	1,900	1,800	2,340	6,040	7,800	1,760	6.8	6.7	5.5
C	39,000	100	2,800	2,100	3,500	8,400	11,700	3,300	8.5	10.1	10.5
D	22,000	108	1,800	2,000	1,980	5,780	7,050	1,270	5.8	5.8	5.5
E	21,000	110	1,700	1,700	1,890	5,290	6,720	1,430	6.8	5.4	5.0
F	54,000	125	3,500	3,100	5,700	12,300	14,600	2,300	4.3	14.0	10.0
G	21,000	98	1,600	1,200	1,700	4,500	6,720	2,220	10.6	5.5	5.5
H	46,000	101	3,400	1,000	4,100	8,500	13,800	5,300	11.5	12.0	12.0

FIGURE 156. Sales, Costs, and Profits by Individual Salesmen

ertheless, the net profit on his sales was quite small, attributable to higher costs of handling his business and a comparatively lower gross profit. Salesman G with a volume less than half that of F produced $2,220 of net profit equal to 10.6% of sales. Careful analysis by top sales management of the variations in results between salesmen with respect to margin and costs can produce the information necessary for effective corrective action.

Analysis by Commodities. The significant feature of any distribution cost accounting system is the functional classification of expense and the bases used in their allocation. Figure 157 illustrates the functions and bases of allocation when an analysis is desired by commodities or commodity groups. This type of analysis points up the relative profitability of different items sold. Decisions relative to discontinuing certain items, or possibly increasing distribution costs to expand the sales of these items can only proceed from a knowledge of the situation as it exists. Such information results from an analysis of the type described here.

Still another illustration involves the case of adding a new commodity to a line of merchandise (Figure 158). The item could be priced to produce a gross profit larger than that yielded by any of the other products sold. It was further assumed before analysis that it would cost almost nothing to distribute this new item as it fitted in well with other items sold. A first analysis undertaken produced the results shown in Figure 158. Product I, the new product, though yielding a substantial gross profit, entailed a substantial distribution cost. It was decided as a result to direct sales effort away from product I and toward the more profitable products D, E, and F. The performance one year later as shown in Figure 158*b* shows a reduced distribution cost for practically every product group and a substantial increase in profit per unit of product.

Analysis by Channels of Distribution. An illustration of analysis by channels of distribution is furnished by a company engaged in manufacturing and marketing an industrial product. The company was accustomed to a policy of complete trade coverage. This included sales to dealers, and industrial users. An attempt was made to gauge the relative profitability of dealers and industrial users and also to measure the relative profit produced by different sizes of orders. The results of the analysis are shown in Figure 159.

Sales to industrial users as a group produce a higher net operating profit than dealer sales, with selling cost per unit in the latter group more than four times higher than in the former. The further analysis by

Functional Cost Groups	Basis of Allocation
1. Receiving stock in warehouses	Physical volume of shipments (cubic inches).
2. Warehouse storage	Physical volume of inventory (cubic inches).
3. Deducting item from balance-of-stock records	Number of invoice lines.
4. Assembling and checking individual items	
5. Packing and shipping individual items	
6. Warehousing and shipping operations—on the order as a whole	Number of invoice lines weighted by average number of invoice lines per order for different classes of goods.
7. Pricing, costing, and typing invoice lines	Number of invoice lines.
8. Passing order for credit	Number of invoice lines weighted by average number of invoice lines per order for different classes of goods.
9. Follow-up records	
10. Heading invoices	
11. Posting to accounts receivable	
12. Filling orders	
13. Order and invoice blanks, postage	
14. Sales statistics of goods sold	
15. Receiving and recording payments	Number of invoice lines weighted by average number of invoice lines per order, weighted, in turn, by average number of orders per month for different classes of goods.
16. Customer statements	
17. Sales correspondence	Number of invoice lines weighted by average number of invoice lines per order, weighted, in turn, by average number of letters per order for different classes of goods.
18. Transportation	Weight shipped—adjusted by geographic zones.
19. Samples and demonstrations	Direct.
20. National advertising	Direct (except institutional ads).
21. Selling (salary, expenses, travel, and cost per salesman for training, supervision, clerical assistance, equipment, and desk room):	Percentages of dollar sales varying with different classes of products which are determined by special studies from time to time.
a. Direct—time spent in presence of customers	
b. Indirect—travel and other time	
22. Mail-order selling	
23. Loss from bad debts and collecting overdue accounts	

FIGURE 157. Functional Classification of Marketing Expenses and Bases of Allocation to Products

volume indicates that dealers in the 1,000-and-over group yield the highest net return while in the case of industrial users, the two middle groups ranging in volume from 100 to 999 units produce the highest profit. Finally, it should be noted that the substantial number of calls yielding no sales in the case of industrial users could be misleading when taken separately, but is apparently worth while when the performance of the group as a whole is examined.

Product Group	Gross Margin, per Unit of Product	Distribution Cost per Unit of Product	Profit or Loss, per Unit of Product
A	$ .46	$ .43	$ .03
B	.45	.53	—.08
C	.24	.42	—.18
D	.99	.64	.35
E	1.08	.58	.50
F	.76	.42	.34
G	.71	.79	—.08
H	.96	.72	.24
I (new product)	1.31	1.25	.06
Averages or totals, entire business	$ .74	$ .65	$ .09

FIGURE 158*a*. Margins, Distribution Costs and Profits, by Product Groups

Product Group	Gross Margin, per Unit of Product	Distribution Cost, per Unit of Product	Profit or Loss, per Unit of Product
A	$ .47	$ .44	$ .03
B	.48	.47	.01
C	.33	.43	—.10
D	.95	.54	.41
E	1.02	.50	.52
F	.76	.35	.41
G	.75	.77	—.02
H	.96	.71	.25
I	1.32	1.18	.14
Averages or totals, entire business	$ .76	$ .59	$ .17

FIGURE 158*b*. Margins, Distribution Costs, and Profits, by Product Groups, Several Territories, One Year Later

Customer-Volume Group, Units of Product Purchased Annually	Number of Customers, Per Cent of Total	Number of Calls, Per Cent of Total	Sales in Units, Per Cent of Total	Gross Margin per Unit (dollars)	Selling Cost per Unit (dollars)	Margin Less Selling Cost (dollars)
All customers:						
Solicited, but not sold	64	27	–	–	–	–
Under 100	7	7	1	.41	.35	.06
100–499	17	25	11	.41	.14	.27
500–999	7	20	12	.35	.10	.25
1,000 and over	5	21	76	.31	.02	.29
Total	100	100	100	.33	.05	.28
Dealers:						
Solicited, but not sold	55	19	–	–	–	–
Under 100	8	7	2	.41	.45	.04 *
100–499	22	29	20	.41	.16	.25
500–999	9	22	23	.35	.10	.25
1,000 and over	6	23	55	.31	.04	.27
Total	100	100	100	.34	.09	.25
Industrial users:						
Solicited, but not sold	79	66	–	–	–	–
Under 100	4	3	1	.41	.15	.26
100–499	10	13	3	.41	.05	.36
500–999	3	4	2	.35	.02	.33
1,000 and over	4	14	94	.31	.01	.30
Total	100	100	100	.32	.02	.30

* Loss.

FIGURE 159. Analysis by Channels of Distribution

Functional Cost Groups	Basis of Allocation to Customers
1. Direct selling expense *a*) Salesmen's salaries and commissions. *b*) Travel expense.	1. Number of salesmen's calls.
2. Sales management *a*) Branch office. *b*) Home office.	2. Number of salesmen's calls.
3. Freight	3. Weight of shipments.
4. Branch office expense	4. Number of salesmen's calls.
5. Home office expense	5. Number of invoices.
6. Credit department	6. Number of invoices.
7. Advertising	7. Relative media circulation (in customer's trading area).
8. Dealer helps	8. 80 per cent to customers in smaller towns and then on basis of sales volume.

FIGURE 160. Analysis by Customers

Analysis by Customers. The bases of allocation by customers or customer groups as shown in Figure 160 are different from those illustrated for other analyses. Using the allocation bases as presented here, the relative profitability of different customer groups is developed in Figure 161*a*. It can be seen that the three last groups of customers, in Figure 161*b*, those not buying at all or buying from $1 to $199 a year, include almost 70% of this company's customers.

Customer-Volume Group, Amount of Annual Purchases	Number of Accounts, Per Cent of Total	Number of Calls, Per Cent of Total	Sales, Per Cent of Total	Gross Profit, Per Cent of Sales	Selling Expense, Per Cent of Sales	Operating Profit, Per Cent of Sales
$20,000 and over	.07	.16	10.91	15.9	4.0	11.9
$10,000–$20,000	.07	.64	2.89	23.6	9.5	14.1
$5,000–$9,999	.60	3.40	11.71	19.8	10.2	9.6
$4,000–$4,999	.40	1.54	5.40	18.4	10.2	8.2
$3,000–$3,999	.40	1.25	3.99	21.8	9.6	12.2
$2,000–$2,999	1.17	3.19	8.47	22.8	10.9	11.9
$1,000–$1,999	3.29	7.21	13.24	23.9	13.4	10.5
$500–$999	7.67	13.40	15.66	25.9	16.8	9.1
$400–$499	3.79	5.09	4.96	29.0	19.3	10.3
$300–$399	5.12	6.27	5.21	31.6	21.9	9.7
$200–$299	9.83	10.75	7.11	31.2	25.3	5.9
$100–$199	16.17	15.65	6.94	30.7	34.3	−3.6
$1–$99	25.64	20.40	3.51	30.9	75.3	−44.4
No Sales	25.78	11.05	–	–	*	–
Totals or averages	100.00	100.00	100.00	25.1	18.7	6.4

* 7.7% of total selling expenses were allocated to "no sales" customers.

FIGURE 161*a*. Customer Analysis on Volume Basis

Expense Classification	Variable Expenses Allocated to 350 Unprofitable Customers	Variable Expenses Which Can Be Eliminated	Variable Expenses Which Cannot Be Eliminated
Delivery	$5,200.00	$ 3,800.00	$1,400.00
Salesmen's salary and travel	4,300.00	4,300.00	–
Inside salesmen's salaries	1,500.00	–	1,500.00
Telephone calls	300.00	300.00	–
Warehousing expense	3,800.00	2,400.00	1,400.00
Office expense	2,800.00	2,000.00	800.00
Auto depreciation	1,200.00	700.00	500.00
Claims	400.00	400.00	–
Total expense eliminated (A)	–	$13,900.00	–
Gross margin lost (B)	–	4,300.00	–
Addition to net profits (A—B)	–	$ 9,600.00	–

FIGURE 161*b*. Results of Elimination of Unprofitable Customers

This company studied the possibility of discontinuing calls on unprofitable customers. Figure 161*b* shows the extent of savings yielded by discontinuing attempts at selling 350 unprofitable customers. It should be noted that Figure 161*b* concerns itself only with a reduction in some variable expenses attributable to these 350 customers. Fixed expenses as well as the portion of the variable expense which cannot be eliminated must be carried by the remaining customers.

Analysis by Order Size. Analysis by order size is an attempt made at measuring the marketing costs assignable to orders based on relative size. In this case a pilot study was undertaken and as a first step the functional costs and the special bases of allocation for this type of analysis were prepared as shown in Figure 162. Costs were then allocated to order-size groups. After this was done the analysis shown in Figure 163 resulted. It indicates in a dramatic way the high cost of handling small orders.

Functional Costs	Bases of Allocation to Order-Size Groups
1. Selling expense—direct: Cost of time spent calling on customers—except sales promotion calls.	Time study by salesmen (for test period, salesmen record time of entering and leaving each store called on).
2. Selling expense—indirect: Travel time, time spent on nonproductive calls, miscellaneous working time, and travel expenses.	Number of calls.
3. Routing orders	Time study (number of orders routed and routing time).
4. Assembling orders and loading trucks.	Time study (each order is assembled separately).
5. Packing: Container forming, packing, container sealing, weighing, preparing bill of lading, stocking containers.	Time study (packing one order is completed—by one packer—before next order is started).
6. Truck delivery—direct: Cost of time spent in customers' stores.	Time study (time clock on truck records time stopped at store and time deliveryman returns to truck).
7. Truck delivery—indirect: Travel time (total time worked less direct time).	Number of deliveries.
8. Freight delivery	Direct (freight charged direct to order).
9. Billing (cutting orders, pricing, extending and comparing orders and invoices).	Time study.
10. Accounts receivable .	Do.
11. Other office costs	Number of orders.
12. Branch rent	Dollar sales.
13. Branch supervision . .	Total direct time of above functions.

FIGURE 162. Allocation Bases to Order-Size Groups

Order-Size Groups, All Customer-Classifications Combined	Warehouse Assembling, Packing, and Routing	Office Billing, Accounts Receivable	Delivery Expenses	Selling Expenses	Other Branch Expense	Total Marketing Costs
$0.01–$3.75	3.11	2.72	5.33	9.40	.96	21.52
$3.76–$6.25	2.10	1.64	3.28	5.62	.96	13.60
$6.26–$8.75	1.56	1.15	2.44	3.89	.96	10.00
$8.76–$11.25	1.25	.90	1.96	3.05	.96	8.12
$11.26–$13.75	1.06	.75	1.65	2.76	.96	7.18
$13.76–$16.25	.90	.64	1.40	2.29	.96	6.19
$16.26–$23.75	.80	.51	1.25	1.96	.97	5.49
$23.76–$31.25	.64	.40	1.00	1.73	.98	4.75
$31.26–$38.75	.56	.33	.87	1.90	.99	4.65
$38.76–$61.25	.51	.25	.79	2.43	.99	4.97
$61.26–$88.75	.41	.17	.65	1.86	.99	4.08
$88.76–$121.25	.38	.13	.59	2.17	1.00	4.27
$121.26–$168.75	.35	.10	.54	2.06	1.00	4.05
$168.76–$231.25	.36	.08	.57	2.29	.99	4.29
$231.26 and over	.34	.06	.57	2.27	1.00	4.24

Based on the operations of 2 branches for 1 month.

FIGURE 163. Marketing Costs by Order-Size Groups

Analysis by Relative Profit Margin Method. The relative profit margin method is submitted as a substitute for the analyses mentioned above, all of which proceed from the determination of distribution functions, the relating of these functions to an activity factor, and a final yielding of unit costs which are then compared by salesmen, territories, etc. The position taken here is that full allocation of all distribution costs is artificial. The following illustrates [3] how unsatisfactory unit costs per salesman call can be:

> If the salesman has called upon the Jones Company and found the purchasing agent was not in, was that a call? You might say, no, let us eliminate that and consider only productive calls. But, what is a productive call and who decides that it falls into that category? I do not believe the salesman will record many nonproductive calls, for his innate optimism will lead him to consider all contacts productive to a degree.
>
> Let us look at a specific case which may help to illustrate the fallacy of unit distribution costs. A manufacturer of closures has a display booth at the annual convention of the Wine and Spirits Institute. It is a good promotional display and attracts many visitors. One of these is Renee Bordeau, managing director of the Algerian-American Wine Company. One of the sales managers at the exhibit meets Mr. Bordeau and, recognizing the importance of Algerian-American in the industry and knowing that they are not a customer of the company, invites him and his purchasing agent, Paul Murray, to lunch. Since Algerian-American is

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[3] I. Wayne Keller, "Relative Profit Margin Approach to Distribution Costing," *N.A.C.A. Bulletin*, March 1, 1949, pp. 761-62.

in the New York district, word is passed on to that office of the contact and salesman Frank Pearce is assigned to develop the account. Pearce calls upon Algerian-American, meets Messrs. Bordeau and Murray and learns that they are planning to market a new wine and, of course, a new wine means a new bottle and a new closure for the bottle. When the model is received, Pearce calls on Algerian-American and extols the advantages of a distinctive custom-made cap. He works with them for a half day on package design but no decision is reached and he leaves. Several days later he calls back, and, after a lengthy discussion, Algerian-American admits that the cap is wonderful but the price of the wine simply will not permit its use.

Pearce is not stopped with that. His company also makes metal screw caps and he immediately points out the superior value of these. At least it would have the Algerian-American trademark lithographed on it. From his sample kit, he produces color combinations and on the spot develops a very attractive closure. But again, Algerian-American does not want that and finally Mr. Bordeau says, "Mr. Pearce, we cannot buy the molded cap and we cannot buy the metal cap, but for your kindness we are giving you an order for 500,000 first grade wine corks."

Well, Pearce was elated. He had cracked a new account. So, on leaving the building, he dropped in to make a golf date with the purchasing agent of Burpy Bottlers who had offices in the same building. Not only did he get the golf date, but he also booked an order for ten thousand gross of crowns. Not a bad day's work.

Let us try to analyze for distribution costing the situation we have just covered. There was general sales promotion effort, i.e., the display at the convention. There was entertainment, which required time and could be considered a call. There was customer service in the designing of the custom-molded cap. Pearce made three sales calls of varying length, the first general and the other two to sell molded plastic caps. He actually sold corks and incidentally sold some crowns—or was that golf date situation a call? It is quite an involved sequence, but it certainly is not unusual.

Suppose we say that each contact of Pearce's was a call and add the four to his other calls and divide them into the total of his salary, travel, and entertainment cost, what do we have? An average which would give Algerian-American too low a charge and Burpy Bottlers too much. Cost per customer would be equally erroneous. Well, let us have Pearce send in time reports and charge customers, products, etc., on his rate per hour. But, will he report time on molded caps when the effort resulted in the sale of corks? Your guess is as good as mine. It is just about impossible to work this into intelligible unit cost development and, even if we could get it all set out absolutely correctly, we would have statistics which might or might not be comparable to those for other men and areas.

All of the foregoing has been included here to point up a fact, and that fact is that you cannot standardize your distribution activity. One writer has said, "Arrive at standards on every element of distribution cost and then control to these standards." I do not think it can be done. I believe the case of Algerian-American which we have just gone over points up the fallacy of unit cost standards for distribution control.

The steps in relative profit margin analysis are:

1. Accumulate net sales (before discounts) by salesmen, territories, or other functional groupings, depending on the unit to be judged.
2. The cost of sales for each unit is deducted to yield gross profit per unit.
3. From the gross profit of each unit are deducted the specific or direct distribution expenses of the unit.
4. The resulting figure represents the contribution towards profit.

The advantages yielded by this system may be summarized:

1. It avoids questions as to the suitability of allocations made for indirect costs and reduces errors in judgment stemming from a failure to understand the allocation of these indirect costs.
2. It facilitates managerial action by separating those segment costs which are affected by managerial decisions regarding that segment from those expenses which are not so affected.
3. Securing the data involves less in clerical expense; also information is available for prompt decision making.

Cost Analysis for Retailer and Wholesaler

Costing Techniques. The principal objective of cost analysis in the retail store is to help the merchant adjust his inventory and his merchandising efforts to sales possibilities so as to yield the greatest profit. With this objective in mind the Bureau of Foreign and Domestic Commerce of the United States Department of Commerce suggests the use of the cost-allocation method, which analyzes distribution costs by functional cost groups. The actual technique of this method of making a cost analysis in a retail store is described below:

Space Costs. For the purpose of allocating space costs, the total store area is divided into two major parts: (*a*) Merchandise-display and storage area, and (*b*) customer and service area. The latter consists of the space normally unoccupied by merchandise, such as aisles and check-out counters used by the customers and by employees in serving the customers. The cost of the customer and service area is not charged to commodities since the amount of space required depends on customer characteristics, such as the number of customers, the number of sales transactions, and customer peak loads. In some stores, this area may occupy as much as 45% of the total store space.

The cost of the remaining area in the store—the space normally devoted to merchandise display and storage—can be allocated to individual commodities on the basis of the number of square feet of display and storage space occupied by, or reserved for, the maximum inventory of the item. (In some cases, cubic feet would be a better measure than square feet.)

The total cost of the display and storage areas in the store divided by the total number of square feet devoted to such space gives a cost per square foot. This cost is then multiplied by the number of square feet of space utilized by the individual item or groups of items.

For greater refinement, the relative selling values of different shelf and display locations in the store may be reflected in the space costs by a weighting which is established on the basis of experience and judgment. This weighting, however, is a rather difficult process.

Space costs include rent—or the equivalent building costs if the building is owned by the retailer—heat, and light. They also include depreciation of store fixtures and equipment and miscellaneous store-maintenance costs.

Inventory Costs. These can be allocated to individual commodities on the basis of their average inventory investment. The total inventory costs divided by the total average inventory value gives a cost per dollar of inventory value. This figure multiplied by the average inventory value of the individual commodity or group of commodities gives its investment costs, which consist of taxes and insurance on inventory and interest expense.

For greater simplicity, in those cases where the investment costs are very small, or where average inventory values of the various commodities do not differ substantially, the investment costs may be combined with the space costs and allocated together on the basis of space occupied. Or, where it is difficult to measure the space occupied by each item, and relative inventory values indicate relative space occupied by different items, the space costs may be combined with the investment costs, and allocated together on the basis of average inventory value. Neither of these two procedures, however, would be as accurate as the one in which space and investment costs are allocated separately.

Direct Costs. In many kinds of retail stores some expenses can be charged directly to specific departments, lines, or commodities. The depreciation, maintenance, and other costs of specialized fixtures and equipment, such as soda fountains, refrigerators, and coffee mills, can be traced directly to the lines or departments benefited. Special supplies and wrapping materials, taxes, and licenses for specific commodities are other examples of direct expense items.

Although these expenses may be relatively minor, they should be charged directly whenever possible. In many cases it may be necessary to make subsequent allocations to determine costs for individual brands or items. For example, although coffee-mill expense is a direct cost of the entire coffee line, it would have to be allocated on the basis of the number of pounds ground to get cost by individual brands.

The total allocated and direct costs of carrying a commodity are subtracted from its dollar gross margin. Any excess represents the commodity's contribution toward the remaining expenses of running the store and is also the measure of the item's relative profitability. The dollar amount—not a percentage rate—of this excess of margin over cost is the basis for comparison. Those items which show the smallest excess of dollar gross margin over allocated costs are relatively unprofitable. Such comparison can be made for all commodities in the store, for the items within a single department, for groups of similar commodities, or for different brands of the same commodity.

Application of Cost Allocation Method. An actual example, using figures taken from the Louisville Grocery Survey, shows the application of the method outlined above. In that survey, space costs were combined with investment costs under the group title of maintenance costs and allocated to commodities as one functional cost group. This group included rent, power, light and heat, insurance, interest on merchandise investment, depreciation on store equipment, licenses, repairs and cleaning, laundry and uniforms, and a portion of salaries representing time spent on stock care. In the grocery department of one combination grocery store, the total of these costs during a six-week period amounted to $169.06. This total of $169.06 was divided by $1,258.62, the average total value of the grocery department inventory during the period, giving a maintenance cost of 13 cents per dollar of average inventory value.

The results for seven brands of packaged coffee are shown in Figure 164. In the first column are the average inventory values which, multiplied by maintenance costs of 13 cents per dollar of average inventory, give the allocated maintenance costs shown in column (2). The maintenance cost is subtracted from the item's dollar gross margin, which is shown in column (4), and the excess of gross margin over allocated costs is shown in column (5).

The relative profitability of the seven brands is shown in column (5). It is up to the grocer to try to replace the unprofitable brands with other products (either coffee or other items) which will bring in a greater dollar gross margin in order to increase the net profits.

Functional Analysis for Wholesaler. A U. S. Department of Commerce publication suggests the following classifications for allocating functional costs to commodities:

1. Storage. Allocated on basis of cubic feet of space occupied by merchandise inventories.

2. Investment. Allocated on basis of ratio of average inventory value of an item to total average inventory value.
3. Handling. Includes wages as well as equipment and supply expenses. Functionally the expense of physical handling includes order assembly, receiving, shipping, etc. These are mainly functions of time. Thus the Department of Commerce suggests:

   > The size, shape, weight, perishability, or nature of the package, and other factors, such as the position of the commodity in the assembly line, are handling-cost determinants only because they affect the time required to handle a single piece of merchandise. Thus, by time study, a standard handling unit may be set up.
   >
   > If the standard handling unit is a case of goods, for example, then barrels, sacks, and other packages may be expressed as multiple or fractional handling units according to their time-of-handling relationship to that of the case of goods (the standard unit).

4. Delivery. This includes
   - *a*) Loading and unloading.
   - *b*) Truck operation.

   Loading and unloading costs may be allocated to commodities on the basis of the number of standard handling units or pieces delivered, truck operation on the basis of weight or bulk. If necessary the commodities may be weighted by delivery zones to take account of distances.
5. Order Routine. This includes order taking and billing. Allocated on basis of invoice lines.
6. Promotion. Allocated on basis of time or number of sales calls.
7. Reimbursement. This covers payments by customers and collection expense. Since these are not affected by commodities, the costs are not allocated to products, but to customers only.

Brand	(1) Average Inventory Investment	(2) Maintenance Cost (1) × $.13	(3) Value of Sales	(4) Gross Margin	(5) Excess of Gross Margin Over Maintenance Costs (4)−(2)	(6) Gross Margin as Per Cent of Sales
D	$2.48	$.32	$ 2.75	$ .39	$ .07	14.2
E	1.35	.18	1.00	.10	.08	10.0
F	1.62	.21	4.95	.78	.57	15.8
G	6.76	.88	112.50	6.75	5.87	6.0
H	3.31	.43	10.00	.70	.27	7.0
I	5.40	.70	207.69	39.05	38.35	18.8
J	1.28	.17	.45	.05	.12	11.1

Source: Louisville Grocery Survey, Part III-A, Merchandising Characteristics of Grocery Store Commodities, Distribution Cost Studies, No. 11. Bureau of Foreign and Domestic Commerce.

FIGURE 164. Relative Profitability of Seven Brands of Packaged Coffee

Any commodity's share of the various functional-cost groups plus any direct costs is the total allocated commodity cost, which is subtracted from its dollar gross margin; the difference indicates the relative profitability of the commodity.

The procedure is the same whether costing commodity lines, departments, or brands, differing merely in the matter of merchandise classification. The wholesaler may cost individual items or brands or he can classify them into a few departments or brand groups. The amount of detail depends on the wholesaler's judgment of the value versus the expense of obtaining the information.

QUESTIONS

1. Why has so little been done in the study of cost accounting for distribution costs if they are as significant as is usually assumed?
2. Compare the technique of functional classification of distribution costs with a similar classification of manufacturing overhead expense.
3. "We pay our salesmen on a straight commission basis. No sales, no commissions. Since our most significant distribution cost is salesmen's commissions, distribution cost accounting is not required in our company." Do you agree? Explain.
4. If distribution cost analysis does not go beyond the step of determining functional costs, it has produced some significant information in relating costs to responsibilities. Comment on this statement and illustrate by reference to specific functions.
5. The accountant too frequently takes a negative approach when asked to comment on the results achieved from his distribution cost study. The approach is too frequently one of cutting out unprofitable products, territories, salesmen, etc. Can distribution cost be used in developing positive sales policies? Explain.
6. List five distribution cost functions and bases for applying these functions to
   a) Products
   b) Territories
   c) Class of customer
   d) Size of order
7. Refer to Question 6 and note the variations in cost application. As a practical matter how would you determine the analysis to be made and the bases to be used when called in to explain the variation in net profit in a company manufacturing and distributing spark plugs for automobiles?
8. List the objections to allocating distribution costs on the basis of dollar sales value.

9. To what extent does the contribution margin approach to distribution cost accounting reduce the volume of detail work usually encountered under a system of complete costing?

10. Describe a desirable method of compensating salesmen where an effective system of distribution cost accounting is in use.

11. Explain how distribution cost analysis is used in planning an advertising campaign, stressing the accounting for cost and the measurement of the effectiveness of the advertising effort.

12. The Alton Company is engaged primarily in the manufacturing and distributing of a wide variety of products. In order to round out its line, the company jobs a related group of products which contribute 10% of total sales volume. In connection with determining the profitability of the different products sold, the problem of allocating cost of the President's, Secretary's, and Treasurer's Departments is under discussion. It has been suggested that these administrative costs be allocated to products on the basis of sales dollars at normal volume. Discuss the propriety of this allocation for products manufactured and sold and for products jobbed.

13. The Beers Corporation is reviewing its traveling expense policy in so far as it affects all employees of the company who may at some time be called to travel on company business. The present policy calls for each traveler to prepare an expense report on which he itemizes daily the various classes of expenses which he has incurred and attaches receipted invoices where necessary. This form is then forwarded to the Home Office where it is reviewed, approved, audited, and paid.

    As can be appreciated, this procedure involves a considerable amount of detailed paper work, and the question of equitable treatment between various employees depends to a great extent upon the willingness of the individual to incur expenses and the degree of control exercised by his superior when the report is presented for approval. The usual result under such a procedure is to enable some individuals when traveling to spend monies far beyond the amounts required either by the work or their position, while other individuals who have the interests of the company at heart economize on their expenditures. Discuss improvements which might be made with regard to the policy outlined above.

Chapter 25

STANDARD DISTRIBUTION COSTS AND REPORTS

Nature of Distribution Cost Standards. The advantages attributable to standards for manufacturing cost apply to standards for distribution costs. Here again, what is sought is a yardstick to which actual costs may be compared. Predetermined expenses set as scientifically as possible with an aim toward achieving a certain goal of performance permit the control of expense and yield a comparison of results and analysis of variations from the standard. As is frequently done in the case of manufacturing cost, standards must be reduced to such form as to permit the measurement of individual performance, i.e., for salesmen, advertising personnel, or delivery personnel.

Steps in Setting Distribution Cost Standards. The steps in setting standards for distribution costs are the same as those explained in the previous chapter. They consist of functional grouping, selection of a factor of variability, and derivation of a standard unit cost for each distribution function. These steps are illustrated in Figure 151 (Chapter 24). Once the functions are determined, it is necessary to estimate the expected cost of the function for the period being budgeted. The total cost of the function divided by the factor to be used in applying this cost (calls, number of orders, weight, invoice lines) yields a standard unit cost for the function which is then used to ascertain profitability by customer, territory, and product classification.

Specific Expense Standards. The most important distribution costs are frequently those relating to salesmen. Accordingly, the following illustration attempts to examine the procedure for setting standards for this expense.[1] The steps in setting standards for salesmen's expenses are:

1. Market survey to determine sales
2. Breakdown of sales by customer outlets

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[1] This illustration is adapted from W. E. Perry, "Distribution Methods and Costs," *N.A.C.A. Bulletin*, February 15, 1947.

3. Setting of standard time for each call
4. Assignment of territories
5. Assignment of costs incurred in making calls and determination of standard rates

MARKET SURVEY. The purpose of a market survey is to ascertain how much of the various products is to be sold and where these products can and should be sold. Such a survey starts with a review of past performance accompanied by a study of external factors including population, spendable income, number of houses, automobiles, telephones, and other indices of purchasing power. The use of the Department of Commerce estimates of gross national product as a general business indicator is suggested at this point.

BREAKDOWN OF SALES BY CUSTOMER OUTLETS. Frequently the analysis of sales by customer outlets is combined with the previous step. The sequence is of minor significance. What is sought here is an analysis of expected sales by towns or, preferably, by customers listed, both in dollars and units. Where sales resistance varies due to local conditions or other factors some weight should be given to this element.

SETTING OF A STANDARD TIME FOR EACH CALL. On the surface this may appear to be an impossible task. Individual differences exist between salesmen and sales situations. Yet, much progress has been made in standardizing techniques in product presentation, showing of samples and photographs, and overcoming customers' objections. The extent of uniformity is evidenced by the prevailing practice in industry of using well-developed training programs in preparing salesmen for their task and attempting to measure performance in terms of their training. Careful experimentation and study is necessary before setting the standard time to be taken for each sales call.

ASSIGNMENT OF TERRITORIES. In dividing up a given marketing area, the aim is to insure adequate coverage within each subdivision or territory. Given the town and customers' quotas and the standard sales call time, territories can be set for each salesman. Frequency of call is a matter which must be considered at this point. Once the territory is laid out, a specific schedule is prepared for the salesman. If the sales season is a six-month period and the salesman works a five-day week he has 1,040 working hours. A standard miles-per-hour travel speed is set and an estimate of travel time deducted from total working hours, leaving the remaining hours for actual selling. The actual selling time divided by the standard selling time per call gives the number of calls the salesman can make. It should be stressed that the technique discussed here makes possible the setting of territories based on desired coverage and sales quotas, an essential feature in the control of salesmen's activities.

ASSIGNMENT OF COSTS AND STANDARD RATES. It is only at this point that the accounting department contributes to the setting of standards by producing a summary of distribution costs consisting of direct costs incurred by those actually selling or handling the product and indirect costs such as advertising, samples, general office, and sales management from which standard rates can be set for each territory (Figure 165).

STANDARD COST ALLOWANCE AND RATES

SALES TERRITORY NO. 2

Item of Cost	Amount	Total
STANDARD WORK LOAD		
Market Survey —Quota for Season	$100,000.00	
Market Survey —Sales Units	200,000.00	
Preplanned Schedules—Calls	1,000.00	
STANDARD COST ALLOWANCE		
Salary —4% of Quota	$ 4,000.00	
Travel Expenses, Living—120 days at $8.00	960.00	
Travel Expenses, Auto —20,000 miles at $.04	800.00	
Direct Costs		$5,760.00
Share of Advertising	$ 600.00	
Share of Sample Expense	60.00	
Share of General Office	400.00	
Share of Management	140.00	
Burden Cost		1,200.00
Total Standard Cost Allowance		$6,960.00
STANDARD RATES		
Direct Costs		
1. Total Direct Cost	$ 5,760.00	
Total Calls	1,000.00	
Standard Cost per Call	$ 5.76	
2. Total Units	200,000.00	
Total Calls	1,000.00	
Total Standard Units per Call	200.00	
3. Standard Cost per Call	$ 5.76	
Standard Units per Call	200.00	
Standard Cost per Unit	$ .0288	
Indirect Costs		
1. Total Indirect Cost	$ 1,200.00	
Total Units	200.000.00	
Total Indirect Cost per Unit	$ .006	

FIGURE 165. Standard Selling Expenses and Rates

Variance Analysis. The significant advantage in the use of standards is the control possible through variance analysis. Such a variance analysis is presented in Figure 166 which is based on the illustrative data contained in Figure 165.

VARIATION ANALYSIS

SALES TERRITORY NO. 2

Item of Cost	Standard	Actual	Variance
PERFORMANCE			
Calls	167	150	− 17
Units	33,333	36,000	+2,667
COST OF OPERATION			
Direct			
36,000 units at $0288	$1,037.00		
Salary		$ 660.00	
Living cost		180.00	
Travel cost		110.00	
	$1,037.00	$ 950.00	+ 87
Indirect—36,000 units at $.0060	216.00	190.00	+ 26
	$1,253.00	$1,140.00	+ 113
ANALYSIS OF VARIANCES			
Effort			
—17 calls at standard rate $5.76			+ 97
Results			
+2,667 units at standard rate $.0288			+ 76
Cost Control			
150 calls at standard rate $5.76	$ 864.00	$ 950.00	− 86
Total Variance			+ 87

FIGURE 166. Variance Analysis of Sales Expense

The analysis presented here covers the salesman's activities for one month in Territory 2. The rates used in converting actual performance in terms of standard are of course the standard rates. The actual costs of operation are furnished by the accounting department. As may be seen from Figure 166, the salesman's performance is judged as to his effort, the results obtained, and the control of his expenses. This is quite similar to analysis of factory overhead variances into efficiency, volume, and budget or spending rate variances, respectively.

There is a total favorable variance of $87. The salesman made 17 calls less than scheduled, expending less sales effort which yielded a favorable variance of $97. It is favorable, however, only in the sense that a saving of that amount occurred because of the smaller number of sales calls. In other words, this saving must be measured against the failure to make the requisite calls thus limiting coverage of the territory. Despite less sales effort, the salesman exceeded his quota by 2,667 units yielding a volume gain of $76. Finally, there was an unfavorable variance in the cost of calls.

A more inclusive type of variance analysis can be obtained where standard and actual costs for all functional distribution elements are compared. Figure 167 sets forth the budget for a given year, the actual results, and the variances. Volume (units) variance equals actual quantity at standard rate compared with standard quantity at standard rate, while the rate variance is derived by comparing actual quantity and standard unit cost with actual quantity at actual cost. A desirable analysis including both fixed and variable cost examination would require the preparation of flexible distribution cost budgets.

Accounting for Standard Distribution Costs. The accounting for standard distribution costs can be demonstrated by reference to a single functional cost item comprising both fixed and variable items. Assume that the standard advertising expense for a month is $20,000 for operations at 100% of budgeted sales and $18,700 for 80% of budgeted sales. Actual advertising expenses of $20,700 were incurred during a month when 80% of the budgeted sales were achieved. The journal entry which follows assumes that the monthly budget is one twelfth of the annual budget. The actual expenditure each month is made without regard to sales volume and represents commitments for a longer period of time.

Advertising Expense	$18,700.00	
Prepaid Advertising	1,300.00	
Advertising Expense Variance	700.00	
Vouchers Payable		$20,700.00

In effect, the difference between the monthly budget at 100% and the expense at 80% is shifted to subsequent months to be absorbed when sales volume exceeds 100% of average monthly budgeted sales. In short, the portion not related to budgeted sales for the specific month must be deferred, while the amount relating thereto is measured against the standard and a variance determined which can then be analyzed.

Distribution Cost Reports

Reports in the field of distribution aim generally at measuring accomplishments in realizing sales quotas and testing the effectiveness of selling effort including sales promotion. In a more specific way these reports cover not only profit margins for each product, territory, or salesman, but also the functional costs of performing the distribution task.

Functional Activity	Unit	(1) Budget	(2)	(3) Actual	(4)	(5)	(6)	(7)	(8)	(9) Variances	(10)
		Quantity	Unit Cost	Quantity	Unit Cost	Budget Total	Allowed Cost for Act. Quart.	Actual Cost	Total (5)-(7)	Volume (5)-(6)	Rate (6)-(7)
Current sales record	Entry	112,500	$ 0498	112,350	$.053	$ 5,602.50	$ 5,595.03	$ 5,954.55	+ $ 352.05	— $ 7.47	+ $ 359.52
Permanent sales record	Entry	5,250	.10	5,150	.093	525.00	515.00	478 95	— 46.05	— 10.00	— 36.05
Sales promotion											
General (Fixed)	Fixed amount	-				6,000.00	6,000.00	6,000 00	-	-	-
Letter writing	Letter	25,000	.24	25,100	.231	6,000.00	6,024.00	5,800.00	— 200.00	+ 24.00	— 224.00
Entering orders											
Headings	Order	60,250	.12	60,200	.1196	7,230.00	7,224.00	7,200.00	— 30.00	— 6.00	— 24.00
Items	Item	301,250	.025	301,000	.0239	7,531.25	7,525.00	7,193.90	— 337.35	— 6.25	— 331.10
Allocating stock	Item	201,000	.021	200,500	.0216	4,221.00	4,210.50	4,350.00	+ 129.00	— 10.50	+ 139.50
Warehousing											
Assembly	Per 100 lbs.	1,205,000	.024	1,202,000	.0241	28,920.00	28,848.00	29,000.00	+ 80.00	— 72.00	+ 152 00
Traffic	Order	60,250	.05	60,200	.049	3,012.50	3,010.00	2,950.00	— 62.50	— 2.50	— 60.00
Bills of lading	Shipment	80,100	.0315	80,050	.032	2,523.15	2,521.58	2,561.60	+ 38.45	— 1.57	+ 40.02
Invoicing	Item	360,300	.035	360,200	.035	12,610.00	12,607.00	12,700 00	+ 90.00	— 3.00	+ 93.00
Shipment service	Inquiry	15,200	.27	15,400	.273	4,104.00	4,158.00	4,200.00	+ 96.00	+ 54.00	+ 42.00
Accounting											
Posting debits	Shipment	80,100	.034	80,050	.0343	2,723.40	2,721.70	2,750.00	+ 26.60	— 1.70	+ 28.30
Statements and cash receipts	Account	5,250	.78	5,150	.80	4,095.00	4,017.00	4,120.00	+ 25.00	— 78.00	+ 103.00
Figure agents' commissions	Shipment	80,100	.0125	80,050	.0137	1,001.25	1,000.63	1,100.00	+ 98.75	— .62	+ 99.37
Credit	Order	60,250	.05	60,200	.0515	3,012.50	3,010.00	3,100.00	+ 87.50	— 2.50	+ 90.00
Collections	Account	5,250	.9524	5,150	1 009	5,000.10	4,904.86	5,200 00	+ 199.90	— 95.24	+ 295.14
Sales compensation	Call	32,000	2.82	31,500	2.92	90,240.00	88,830.00	91,980.00	+ 1,740.00	— 1,410.00	+ 3,150.00
Sales travel	Mile	250,000	.20	248,000	.209	50,000.00	49,600.00	51,832.00	+ 1,832.00	— 400.00	+ 2,232.00
Supervision (Fixed)	Fixed amount	-				49,000.00	49,000.00	49,000.00	-		
Advertising (Fixed)	Fixed amount	-				5,224.00	5,224.00	5,224.00	-		
						$298,575.65	$296,546.30	$302,695.00	+ $4,119.35	— $2,029.35	+ $6,148.70

FIGURE 167. Variance Analysis by Distribution Cost Functions

Reports on Salesmen's Performance. Where standard distribution costs are used reports detailing salesmen's performance should cover:

1. Sales effort: standard calls scheduled versus actual calls made and resulting variances
2. Sales volume: standard sales units scheduled versus units sold and resulting variances
3. Sales cost: standard cost allowed for calls made compared with actual costs and resulting variances

The above have already been covered in connection with Figure 165. Where standard costs are not in use it is possible to derive reports indicating net profit performance by salesmen. The net profit yielded by each salesman's performance often forms the basis for bonus payments.

Special Reports to Management.[2] The reports discussed in this section are aimed at presenting information with regard to specific sales management problems. They are therefore reports derived from records developed in distribution cost accounting for use as the occasion demands. To illustrate, reports are included covering customer size and volume, analysis by channels of distribution, analysis by territories, analysis by salesmen.

CUSTOMERS, VOLUME, GROSS PROFITS, VARIABLE MARKETING EXPENSES AND NET PROFIT OR LOSS, BY CUSTOMER-VOLUME GROUPS

Customer-Volume Group, Number of Units Purchased During Week	Customers, Per Cent of Total	Volume, Per Cent of Total	Gross Profit per 100 Units (dollars)	Variable Expenses, per 100 Units (dollars)	Net Profit * per Units (dollars)
Customers unsuccessfully solicited	17.1	–	–	–	–
1–25	7.6	0.2	$1.66	$4.01	†—$2.35
26–50	8.3	.7	1.38	2.55	†— 1.17
51–100	12.0	1.9	1.25	1.78	†— .53
101–150	9.3	2.4	1.26	1.32	†— .06
151–200	7.8	2.9	1.14	1.13	.01
201–250	6.4	3.0	1.12	.95	.17
251–500	17.1	13.2	1.06	.75	.31
501–1000	12.7	18.6	1.02	.49	.53
1,001–10,000	1.7	57.1	.81	.24	.57
Total	100.0	100.0	–	–	–

* Gross profit less variable expenses only.

† Loss.

FIGURE 168. Report Based on Analysis of Customer Volume

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[2] The illustrations used here, unless otherwise noted are based on "How Manufacturers Reduce Their Distribution Costs," United States Department of Commerce (1948).

Customer Size and Volume. Figure 168 shows a report resulting from allocation of the variable distribution expenses to customer groups based on units purchased to indicate the relative profitability in selling these customers. While on the surface it would appear that in this case a larger profit would be yielded by dropping all customers purchasing less than 151 units, management could well concern itself with the measures necessary to convert these customers to the point where they would yield a profit.

A more detailed report, as illustrated in Figure 169, shows an allocation of distribution costs to customer-volume groups based on average monthly sales to these customers. As the monthly volume per customer increases, quantity discounts result in a decrease in the gross profit rate. In the instant case the most profitable business is yielded by customers in the $1,500-$7,499 range. As was noted before, the low-volume customers yield a loss and must be under constant scrutiny to ascertain whether they can ever produce a volume which might yield a profit.

The final illustration in this group of reports (Figures 170 and 171) first develops an allocation of fixed and variable distribution cost by customer size based on annual sales volume and then yields a very valuable series of percentages indicating the relationship between operating expense for each customer class and sales volume. The information on the number of customers in each group and the average size of order is very helpful in directing sales effort and measuring performance.

Territories. Many uses have been made of distribution cost data assembled on a territorial basis. One company classifies each sales territory into markets based on standard unit sales per call and number of calls and then compares actual performance to the standard. As a result significant data are collected permitting the shifting of sales effort to profitable markets (Figure 172).

Another company has developed a technique for measuring profitability by towns visited by their salesmen (Figure 173). The cost of a salesman's time is determined by adding together his salary, his personal maintenance expense (hotel, restaurant, etc.), and a cost per salesman for training, supervision, clerical assistance, equipment, and desk room. The total, divided by the number of working hours, gives selling cost per salesman's hour. This is multiplied by the hours spent in each town to get the intratown cost or direct selling cost for the town.

From the salesman's daily reports are derived the number of calls, number of sales, dollars of sales, and class of goods. Next, the gross yield of the sales is estimated (the result of subtracting the factory cost and order-filling cost from sales price). The gross yield minus the direct selling cost per town gives the net yield per town. The intertown

SALES, MARGINS, FIELD MARKETING COSTS, AND RELATIVE PROFITS FOR ROUTE SALES-AND-DELIVERY CUSTOMERS, BY CUSTOMER-VOLUME GROUPS[1]

(1) Customer-Volume Group, Volume of Monthly Purchases	(2) Number of Customers, Per Cent of Total	(3) Sales Volume, Per Cent of Total	(4) Gross Margin, Per Cent of Sales[2]	(5) Route Selling and Delivery Cost, Per Cent of Sales	(6) Route Stop Time, Per Cent of Total	(7) Selling Costs, Per Cent of Sales	(8) Number of Sales Calls, Per Cent of Total	(9) Other Branch and District Costs, Per Cent of Sales[3]	(10) Total Field Marketing Costs, Per Cent of Sales (5)+(7)+(9)	(11) Relative Profits, Per Cent of Sales (4)−(10)
1–149	76.9	10.5	45.9	18.3	52.1	15.1	35.9	20.8	54.2	–8.3
150–299	10.4	7.3	45.6	8.5	15.7	16.6	24.7	19.2	44.3	1.3
300–499	4.7	6.0	45.4	5.5	8.1	13.0	14.1	15.9	34.4	11.0
500–999	3.3	7.6	42.9	3.9	6.9	8.8	10.6	12.3	25.0	17.9
1000–1499	1.0	4.4	39.9	3.1	2.9	7.5	4.2	11.8	22.4	17.5
1500–2999	1.5	10.7	36.8	2.1	4.3	3.1	3.8	6.5	11.7	25.1
3000–4999	.9	11.0	33.3	1.7	3.2	2.7	2.7	5.2	9.6	23.7
5000–7499	.6	11.3	29.4	1.5	2.3	1.8	1.6	3.7	7.0	22.4
7500–9999	.3	9.5	25.0	1.6	1.9	1.6	1.0	4.2	7.4	17.6
10,000 and up	.4	21.7	17.2	1.3	2.6	1.1	1.4	2.6	5.0	12.2
Total of averages, entire business	100.0	100.0	34.8	5.1	100.0	6.8	100.0	9.7	21.6	13.2

[1] Data cover one district for three months.

[2] Gross margin variations are due to quantity discounts.

[3] Includes branch and route settlement costs, sales supervision, clerical costs, and other costs.

FIGURE 169. Customer-Volume Report Based on Average Monthly Purchases

COST OF SERVING CUSTOMERS, ACCORDING TO ANNUAL SALES VOLUME

(Expressed as percentage of sales)

Annual Sales	Total Operating Expense	Maintenance	Movement	Delivery	Sales Promotion	Reimbursement
Under $10	201.041	2.577	45.537	4.479	0.000	148.448
$10.01–$100	58.742	2.577	18.597	1.829	.713	35.026
$100.01–$250	37.812	2.577	11.407	1.122	1.499	21.207
$250.01–$500	29.034	2.577	12.393	1.219	3.433	9.412
$500.01–$750	34.243	2.577	13.954	1.373	10.700	5.639
$750.01–$1,000	29.527	2.577	12.606	1.240	9.179	3.925
$1,000.01–$2,000	22.939	2.577	11.484	1.129	5.515	2.234
$2,000.01–$3,000	16.707	2.577	8.130	.799	3.898	1.303
$3,000.01–$4,000	12.801	2.577	6.096	.600	2.747	.781
$4,000.01–$5,000	10.828	2.577	5.345	.526	1.780	.600
$5,000.01–$6,000	10.186	2.577	4.790	.471	1.886	.462
$6,000.01–$7,000	10.376	2.577	4.629	.455	2.327	.388
$7,000.01–$8,000	7.627	2.577	3.085	.303	1.320	.342
$8,000.01–$9,000	9.860	2.577	4.354	.428	2.225	.276
$9,000.01–$10,000	9.994	2.577	4.420	.435	2.340	.222
$10,000.01–$15,000	7.456	2.577	3.611	.355	.727	.186
$15,000.01–$20,000	5.898	2.577	2.749	.270	.184	.118
$20,000.01–$25,000	9.373	2.577	4.375	.430	1.868	.123
Over $25,000	7.705	2.577	3.377	.332	1.346	.073
Average	16.237	2.577	7.229	.711	3.143	2.577

Source: Edward J. Carroll, *Wholesale Druggists' Operations*, Domestic Commerce Series No. 86, Bureau of Foreign and Domestic Commerce.

FIGURE 170. Report of Expenses Related to Customer Volume

Customer Class	Number of Customers	Operating Expense (per cent of sales)	Average Order
Under $10	995	201.0	$ 2.75
$10.01–$100	995	58.7	6.73
$100.01–$250	242	37.8	10.97
$250.01–$500	173	29.0	10.09
$500.01–$750	103	34.2	8.96
$750.01–$1,000	81	29.5	9.92
$1,000.01–$2,000	191	22.9	10.89
$2,000.01–$3,000	118	16.7	15.39
$3,000.01–$4,000	66	12.8	20.52
$4,000.01–$5,000	49	10.8	23.40
$5,000.01–$6,000	34	10.2	26.11
$6,000.01–$7,000	23	10.4	27.02
$7,000.01–$8,000	13	7.6	40.55
$8,000.01–$9,000	8	9.9	28.73
$9,000.01–$10,000	7	10.0	28.30
$10,000.01–$15,000	11	7.5	34.65
$15,000.01–$20,000	2	5.9	45.48
$20,000.01–$25,000	2	9.4	28.60
Over $25,000	2	7.7	37.03
	3,115	16.2	$17.30

Source: Edward J. Carroll, *Wholesale Druggists' Operations*, Domestic Commerce Series No. 86, Bureau of Foreign and Domestic Commerce.

FIGURE 171. Results of Cost Analysis by Customer-Volume Classes

SALES IN NUMBER OF PRODUCT UNITS PER CALL, AND NUMBER OF CALLS BY MARKETS, STANDARD COMPARED WITH ACTUAL, ALL REGIONS

Markets*	Regions						
	1	2	3	4	5	6	Standard
AAA market:							
Sales	88	144	154	87	120	56	150
Calls	19.2	8.2	20.7	38.1	12.6	34.9	20.0
AA market:							
Sales	89	124	103	81	62	50	100
Calls	6.3	5.3	10.2	10.3	11.3	12.9	10.0
A market:							
Sales	54	91	77	98	55	44	80
Calls	4.2	3.5	5.7	4.5	6.6	7.4	5.0
B market:							
Sales	33	65	52	75	45	36	60
Calls	2.4	1.8	3.7	2.3	3.5	3.0	3.0
C market:							
Sales	82	109	105	86	63	47	50
Calls	9.0	4.0	7.9	2.7	7.1	8.1	2.0
D market:							
Sales	10	51	35	60	23	27	20
Calls	.7	.8	.8	1.1	1.3	1.2	1.0

* Markets are classified as AAA, AA, etc., on the basis of the potential volume of business available for each product, which, in turn, is based on a careful study of market indicators.

FIGURE 172. Report Reflecting Territorial Analysis

WORKING FORMULAS

$$\left.\frac{\begin{array}{c}\text{Salesmen's Salary plus Food and Lodging plus}\\ \text{Cost per Salesman for Training, Supervision,}\\ \text{Clerical Assistance, Equipment and Desk Room}\end{array}}{\text{Working Hours}}\right\} = \text{Cost per Salesman Hour}$$

$$\left.\begin{array}{c}\text{Cost per}\\ \text{Salesman}\\ \text{Hour}\end{array}\right\} \times \left\{\begin{array}{c}\text{Hours}\\ \text{in}\\ \text{Town}\end{array}\right\} + \left\{\begin{array}{c}\text{Local}\\ \text{Trans-}\\ \text{portation}\\ \text{Costs}\end{array}\right\} = \left\{\begin{array}{c}\text{Intratown Cost}\\ \text{or Direct Cost}\\ \text{for Town}\end{array}\right.$$

$$\left.\frac{\begin{array}{c}\text{Cost of Time between Towns}\\ \text{plus Intertown Transportation}\end{array}}{\text{Miles Traveled}}\right\} = \left\{\begin{array}{c}\text{Cost}\\ \text{per}\\ \text{Salesman}\\ \text{Mile}\end{array}\right.$$

FORM OF REPORT

Route No. .... Salesman . . Period .. ..

TOTALS FOR PERIOD

Town	Salesman's Hours	No. of Calls	No. of Sales	Dollars of Sales	Gross Yield	Selling Cost	Net Yield
Portsmouth, Dover, Rochester, Concord, Manchester, Etc.							
Total Intratown cost Total Intertown cost							
Total Cost .							

RATIOS

Town	Time per Call	Calls per Sale	Dollars per Sale	Gross Yield per Sale	Cost per Sale	Net Yield per Sale	Net Yield per Salesman's Hour
Portsmouth, Dover, Rochester, Concord, Manchester, Etc. .							
Total Intratown cost Total Intertown cost .							
Total Cost .							

FIGURE 173. Analysis of Earnings by Towns

cost includes the time plus transportation cost for travel between towns. This cost is allocated on the basis of the most profitable way of traveling the territory.

The analysis in the lower part of Figure 173 shows the net yield per salesman's hour for different towns. Before a town is eliminated a careful review is made of the alternative uses of the sales effort expended in this town and the general needs of the business relative to volume of sales and rate of expansion.

X COMPANY

STATEMENT OF PROFIT AND LOSS

YEAR ENDED ——— 19—

(Conventional Form)

Sales		$1,000,000.00
Cost of Sales		925,000.00
Gross Profit		$ 75,000.00
Operating Expenses		
Executive Salaries	$20,000.00	
Clerical Salaries	6,000.00	
Field Sales Expenses	20,000.00	
Advertising	300.00	
Receiving, Shipping, and Handling	8,000.00	
Delivery Expenses	1,800.00	
Depreciation Delivery Equipment	1,500.00	
Telephone, Telegrams and Supplies	1,000.00	
Occupancy, Light, and Heat	6,000.00	
Insurance and Taxes	1,400.00	
Auditing and Legal	1,200.00	
Total Operating Expenses		67,200.00
Net Profit		$ 7,800.00

FIGURE 174. Conventional Operating Statement

X COMPANY

STATEMENT OF PROFIT AND LOSS

YEAR ENDED ——— 19—

(Functional Type)

Sales		$1,000,000.00
Cost of Sales		925,000.00
Gross Profit		$ 75,000.00
Operating Expenses		
Sales and Advertising	$27,945.00	
Credit and Collections	2,205.00	
Order Writing, Billing, Accounting	5,235.00	
General and Administrative	9,970.00	
Receiving, Shipping, and Handling	21,845.00	67,200.00
Net Profit		$ 7,800.00

FIGURE 175. Functional Operating Statement

General Reports. The traditional profit and loss statement prepared for internal management has long been criticized because it attempts only a partial expense classification. Primarily, expenses are classified by their nature whereas the control of expense is generally achieved through control of functions. Where distribution cost accounting is used a functional profit and loss statement may be prepared as a by-product of the detailed costs previously collected. To illustrate, Figure 174 shows a profit and loss statement in conventional style while Figure 175, using the same information, sets forth a profit and loss statement using functional classifications. The functional profit and loss statement is ordinarily supplemented by schedules listing the composition of the expenses under each function.

QUESTIONS

1. Explain the steps in setting standards for the warehousing function.
2. The common observation with regard to salesmen is that they are born and not made and that they face such a variety of situations that standards cannot be used. Show what phases of the salesman's tasks can be standardized.
3. *a*) What is a distribution cost standard?
   b) How is it set?
   c) Explain its use in preparing a budget of distribution costs.
4. Manufacturing cost analysis stresses decreasing costs while distribution cost analysis frequently results in the need for increasing costs. Explain.
5. Outline the approach to reporting to management on the desirability of discontinuing operation in a territory which in recent years has failed to produce a profit.
6. Outline the development of a standard for the job of invoice typing.
7. Explain the use of a flexible budget in connection with setting standards for the warehousing and shipping functions.
8. Sales territories are too frequently established on a hit or miss basis. How can an effective system of distribution costing aid in the laying out of suitable sales territories?
9. Explain the accounting treatment of a volume variance in distribution costs resulting from the situation where the month under study generally produces a sales volume below average due to seasonal conditions.
10. Is unit cost the most practicable approach to distribution cost analysis? What are the alternatives?
11. Outline the costs entering into the delivery function and the types of variances resulting from a comparison of standard and actual delivery costs.

Chapter 26

PROFIT PLANNING

Relationship Between Volume and Profit. Earlier chapters have pointed out the fact that some manufacturing costs vary with volume of goods produced while other costs are fixed and do not rise and fall in total amount with ordinary changes in production volume. Selling and administrative costs behave similarly under conditions of fluctuating sales volume, although the proportion of fixed costs is often larger than with manufacturing costs. Since some costs do not increase proportionately as the volume of goods sold increases, profits tend to increase out of proportion as volume grows beyond the point where the fixed charges have been recovered in the selling price. For the same reason, profits tend to decline more rapidly than sales income when sales volume drops. This situation is illustrated below.

The following figures are the operating costs incurred to operate a truck during a given year when the truck was driven 20,000 miles.

Costs which vary with mileage		
Gasoline	$477.68	
Oil	29.20	
Tires	72.00	
Repairs	93.60	
Greasing	38.00	
Washing	20.00	$ 730.48
Annual fixed costs		
Depreciation	$400.00	
Insurance	70.00	
License	18.20	488.20
Total costs		$1,218.68

The owner of the truck has an opportunity to contract for use of the truck during the next year at 8 cents per mile and wishes to know how much profit he will make if it is rented out at this rate. Assuming operating costs continue to be incurred at the same rates per mile and per year, the answer to the above question depends upon the number of miles the truck is operated. During the past year operating costs per mile have been as follows:

Variable ($730.48 ÷ 20,000)	$.0365
Fixed ($488.20 ÷ 20,000)	.0244
Total	$.0609

However, because of the presence of fixed charges, changes in mileage produce fluctuations in the cost per mile. The results are shown below at varying mileages from 10,000 to 30,000 per year:

	Total Costs			Cost per Mile		
Mileage	Fixed	Variable	Combined	Fixed	Variable	Combined
10,000	$488.20	$ 365.00	$ 853.20	$.0488	$.0365	$.0853
15,000	488.20	547.50	1,035.70	.0325	.0365	.0690
20,000	488.20	730.48	1,218.68	.0244	.0365	.0609
30,000	488.20	1,095.00	1,583.20	.0163	.0365	.0528

From the above it can be seen that the cost per mile decreases as the number of miles increases. Hence the profit margin also increases with increasing use of the truck:

Mileage	Rental Income at 8¢ per Mile	Total Cost	Profit
10,000	$ 800.00	$ 853.20	$(53.20)*
15,000	1,200.00	1,035.70	164.30
20,000	1,600.00	1,218.68	381.32
30,000	2,400.00	1,583.20	816.80

* Loss.

Thus, doubling the mileage from 15,000 to 30,000 miles reduces the total cost per mile 1.62 cents or roughly 23%. The total profit, however, increases from $164.30 to $816.80 or almost 400%. While a very simple situation has been chosen for the illustration above, profits in any business may be expected to exhibit the same tendency.

In order to determine what effect changes in volume produce on profits, it is necessary to analyze costs into their fixed and variable components. Methods for doing this have been described in an earlier chapter. These techniques must be applied to both manufacturing costs and nonmanufacturing costs (i.e., costs of marketing the products and costs of general administration). In other words, all costs deducted from sales income to arrive at operating profit are analyzed into fixed and variable portions. If standard costs with flexible standards for expenses are available, the needed separation of costs into fixed and variable components has already been made. If no study of costs to determine fixed and variable components has been made, it is necessary to begin the analysis of profit-volume relationships by such a study of costs. The more carefully this analysis is made, the smaller will be the margin of error in the final results.

One of the principal uses made of information about profit-volume relationships is as an aid in budgetary planning. For this reason, the costs budgeted for the coming period rather than the actual costs of prior periods serve as the source of data for the analysis of profit-volume relationships. Figure 176 shows a budget with costs analyzed into fixed and variable components.

EASTERN MANUFACTURING COMPANY

BUDGETED OPERATING STATEMENT FOR 19—

		Cost Breakdown		
	12-Month Total	Fixed Cost	Variable Cost	
			Per Cent	Amount
Sales Value of Production	$6,000,000.00		100 00%	
Manufacturing Cost				
Materials consumed	$1,200,000.00		20.00%	$1,200,000.00
Direct labor	1,500,000.00		25.00	1,500,000.00
Departmental indirect labor	186,000.00	$ 36,000.00	2.50	150,000.00
General supervision, production control, engineering, services, etc.	246,000.00	102,000.00	2.40	144,000.00
Occupancy expense	48,000.00	30,000.00	.30	18,000.00
Equipment maintenance	156,000.00	6,000.00	2.50	150,000.00
Process power, gas	66,600.00	6,000.00	1.01	60,600.00
Factory supplies, etc.	22,200.00	4,200.00	.30	18,000.00
Insurance, federal old age, unemployment, pensions, vacations	229,200.00	13,800.00	3.59	215,400.00
Depreciation	96,000.00	96,000 00		
Total manufacturing cost	$3,750,000.00	$ 294,000.00	57.60%	$3,456,000.00
Administrative Expenses				
Salaries and wages	$ 336,000.00	$ 282,000 00	.90%	$ 54,000 00
Occupancy	18,000.00	15,000.00	.05	3,000.00
Communications, stationery, supplies, etc.	24,000.00	9,000.00	.25	15,000.00
Insurance, F.O.A., unemployment, etc.	33,000.00	27,000.00	.10	6,000.00
Depreciation	9,000.00	9,000.00		
Total administrative expense	$ 420,000.00	$ 342,000.00	1.30%	$ 78,000.00
Selling Expense				
Salaries, wages, commissions	$ 214,500.00	$ 109,500 00	1.75%	$ 105,000.00
Occupancy	9,000.00	6,000.00	.05	3,000.00
Communications, stationery, supplies, etc.	36,000.00	6,000.00	.50	30,000.00
Insurance, F.O.A., unemployment, etc.	21,000.00	10,200.00	.18	10,800.00
Depreciation	7,500.00	7,500.00		
Advertising	150,000.00	64,800.00	1.42	85,200.00
Total selling expense	$ 438,000.00	$ 204,000 00	3.90%	$ 234,000.00
Deductions from Sales				
Defective returns	$ 30,000.00		.50%	$ 30,000.00
Cash discounts	108,000.00		1.80	108,000.00
Allowances	54,000.00		.90	54,000.00
Total deductions from sales	$ 192,000.00		3.20%	$ 192,000.00
Total operating cost	$4,800,000.00	$ 840,000.00	66.00%	$3,960,000.00
Marginal income			34.00%	2,040,000.00
Break-even volume of operations		$2,470,000.00		
Profit before income taxes	$1,200,000.00			
Sales value of production	$6,000,000.00		100.00%	$6,000,000.00

Source: Charles H. Gleason, "The Profit-Volume Relationship," *N.A.C.A. Bulletin,* July 1, 1947, p. 1337.

FIGURE 176. Budget Analyzed by Fixed and Variable Costs

Graphic Analysis of Cost–Volume–Profit Relationships. The relationships between costs, volume, and profits are best visualized by charting the figures. Charts used for this purpose are called break-even charts or, in modified form, they are called "profitgraphs." A break-even chart based upon the budget shown in Figure 176 is presented in Figure 177. This chart involves the following points:

1. Choice of scales
2. Plotting variable cost line
3. Plotting total cost line
4. Plotting sales income line

Scales were chosen with the horizontal scale representing volume measured in sales value of production and the vertical scale representing dollar amounts of costs or sales income. Sales value of production is often used as a measure of volume for a multiproduct company, although man-hours or some other physical coefficient may be substituted.

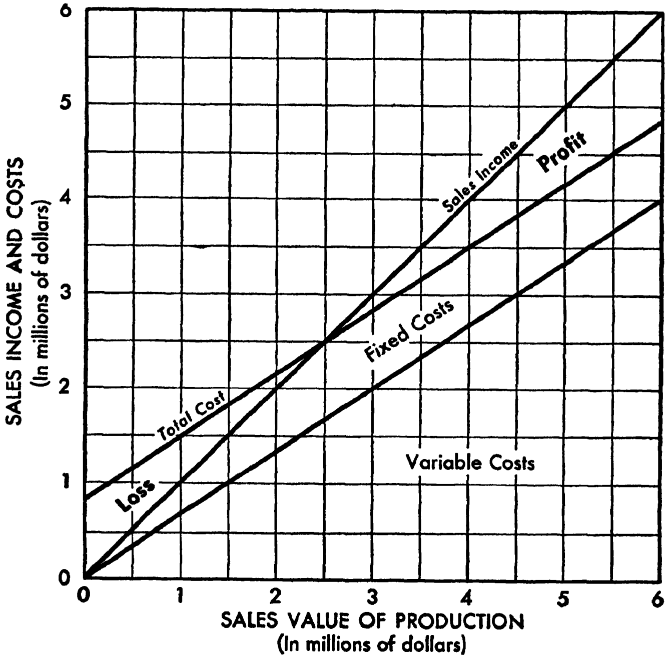

Figure 177. Break-Even Chart (variable costs plotted first)

The above method produces a 45° slope for the sales curve. In other words, it assumes that production equals sales. It is, however, possible for budgeted sales and budgeted production to differ. Hence it is possible to construct a break-even chart in which the horizontal axis represents percentages of capacity and the vertical axis dollar values of cost and of sales income. When, however, the quantity produced does not equal the quantity sold, variations are produced between the opening and closing inventories. It is for this reason that the method in Figure 176 was chosen. In effect inventory variations are avoided, the budgeted sales figure is omitted from the calculation, and there is substituted for it the sales value of production. In this way production and sales are equated and produce the diagram shown in Figure 177.

The variable cost line was plotted by use of three points, the third point acting as a check upon the others. The points selected were the variable costs at a sales volume of $6,000,000, $3,000,000, and zero. Total variable cost at a sales volume of $6,000,000 is given in the budget (Figure 176) as $3,960,000, or 66% of sales; for the $3,000,000 volume it is necessary to compute the amount of variable cost by multiplying the sales figure by the percentage which variable costs bear to sales ($3,000,000 × 66% = $1,980,000); and at zero sales volume variable cost is also zero. The equation of the variable cost line shown on the chart in Figure 177 is thus:

Variable cost = .66 × Sales value of production.

The slope of the line in Figure 177 (i.e., the amount by which cost increases with each increase of $1 in sales value of production) is determined by the ratio between variable cost and sales value of production.

The total cost line in Figure 177 was plotted by use of two points. The first of these is located by plotting the amount of fixed cost ($840,000) on the vertical scale at zero volume. The second point is located by plotting the total cost (i.e., fixed plus variable or $4,800,000) for the sales volume of $6,000,000. When a line is drawn to connect these two points, the fixed costs are shown as a band extending between the total cost line and the variable cost line. This upper line is parallel to the lower one because fixed costs remain the same at any volume shown on the chart; if the lines as drawn are not parallel an error in plotting the two points has been made.

The income line in Figure 177 was plotted by drawing a line from a point representing total sales income at a sales volume of $6,000,000 to the origin of the chart. The latter point represents sales income of zero at zero volume. Hence the two points determine the location of the sales line on the chart.

An alternative method consists of plotting the fixed costs first, then the total costs and sales income. The results are shown in Figure 178 in which the fixed costs appear as a band across the bottom portion of the graph.

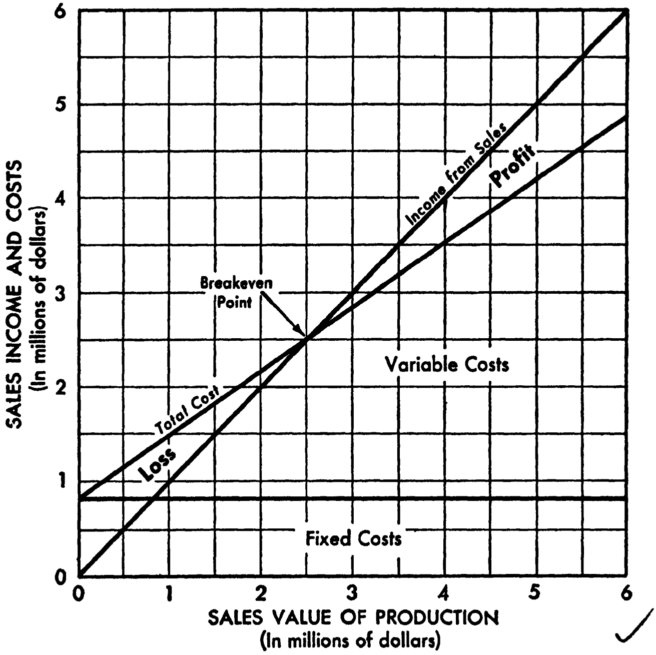

FIGURE 178. Break-Even Chart (fixed costs plotted first)

Interpretation of the Break-Even Chart. From the charts in Figures 177 and 178 it can be seen that costs exceed sales income and the business operates at a loss at sales volumes just below $2,500,000 per year. The amount of the loss at any given volume is shown on the chart as the vertical distance between the total cost and sales income lines. As volume increases, the amount of the loss decreases until a volume of $2,470,000 per year is reached. At this volume the two lines intersect and the business "breaks even" since income from sales exactly covers costs. At volumes above the break-even point, sales income exceeds costs and the business operates at a profit instead of a loss. With increasing volume, the amount of profit earned increases, as may be seen from the increasing vertical distance between the income and cost lines on the chart as volume increases beyond the break-even volume.

The real meaning of the break-even chart is this: that the fixed costs have all been covered at the break-even point. Any increase in volume beyond this point carries only variable costs, hence profits increase more rapidly than before the break-even point. This is the real reason for the rapid jump in profits in the earlier illustration of the trucking costs. Somewhere between 10,000 and 15,000 miles lies the break-even point, since the earnings change from an indicated loss of $53.20 to a profit of $164.30.

Another type of break-even chart is sometimes used to make it easier to see how profits change with volume. This chart is illustrated in Figure 179. A single line is drawn to represent the difference between the total cost and income areas in Figures 177 and 178. This type of chart is frequently referred to as a profitgraph. It is also known as a marginal income chart.

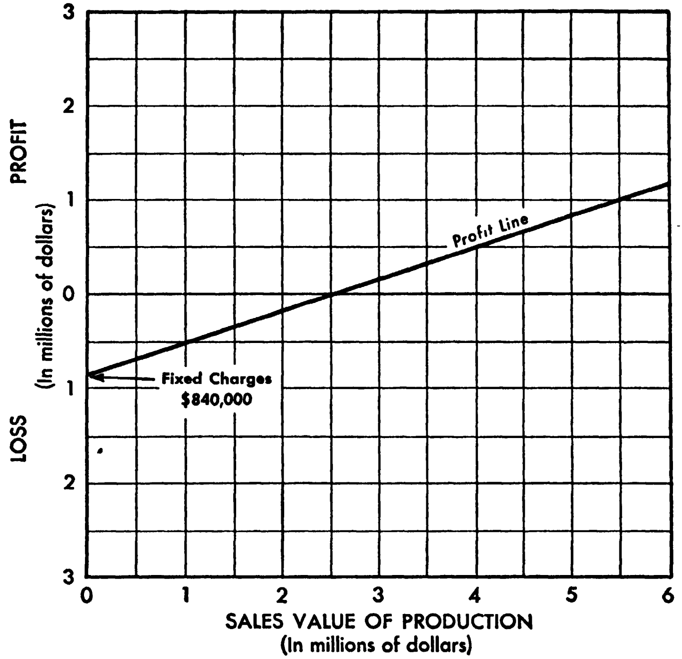

FIGURE 179. Profitgraph (Marginal Income) Form of Break-Even Chart

To draw this chart, the profit line was determined by use of three points as follows:

1. The amount of profit at volume of $6,000,000 is $1,200,000.
2. The loss at zero volume. This is equal to the amount of fixed costs, $840,000.
3. The break-even point, determined by calculation from the formula:

$$\text{Break-even volume} = \frac{\text{Fixed costs}}{1 - \dfrac{\text{Variable costs}}{\text{Sales}}} = \$2,470,000$$

A break-even chart in this form makes it easier to read the amount of profit which can be expected at any volume in question. However, it does not show the relationships between costs, sales income, and volume as do the charts in Figures 177 and 178. In practice the type of chart drawn is determined by the principal interest of persons who are to use it.

Profit Structure of a Company. Analysis of the sales income dollar into the proportions required to cover (1) variable costs and (2) fixed costs plus profit gives information of significance in planning operations. This type of analysis proceeds as follows:

	Totals	Per Cent of Sales Dollar
Sales income	$6,000,000	100.0
Variable cost	3,960,000	66.0
Margin available for fixed costs and profits	$2,040,000	34.0

The ratio of variable costs to sales is usually called the *variable cost ratio*. As the variable cost ratio increases, the variable cost line on the break-even chart rises more steeply with increasing volume.

The balance remaining after deducting variable costs is termed the *marginal income ratio* if it is expressed as a percentage of the sales dollar and the *marginal balance* or marginal income if expressed as an amount.[1] The marginal income ratio determines the rate at which profits increase (or losses decrease) as volume increases. Thus for a company having a marginal income ratio of 34%, profits increase by 34 cents with each dollar of added sales *after volume passes the break-even point.* When volume is below the break-even point, each dollar of added sales covers the 66 cents variable cost and contributes 34 cents toward the fixed costs. A glance at the break-even formula shows that it can be stated in simpler form:

$$\text{Break-even volume} = \frac{\text{Fixed costs}}{1 - \dfrac{\text{Variable costs}}{\text{Sales}}} = \frac{\text{Fixed costs}}{1 - \text{Variable cost ratio}}$$

$$= \frac{\text{Fixed costs}}{\text{Marginal income ratio}}$$

For this reason, the break-even volume of sales can be computed by dividing the marginal income ratio into the fixed costs. In other words, if the marginal income ratio is 34% and fixed costs are $840,000, the break-even point equals $840,000 divided by .34 or $2,470,000. In effect, then, the marginal income ratio is the complement of the variable cost ratio; subtracting the latter from 100% gives the marginal income ratio. The slope of the profit line on the chart in Figure 180 is determined by the marginal income ratio. That is, the profit line rises by the amount of the marginal income ratio with each increase of $1.00 in sales volume.

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[1] These terms should not be confused with the term "marginal income" used in economics. The accounting terms used above come from the accounting use of "margin" to mean a balance or remainder as in the term "gross margin." Some writers use "margin of income ratio" rather than "marginal income ratio."

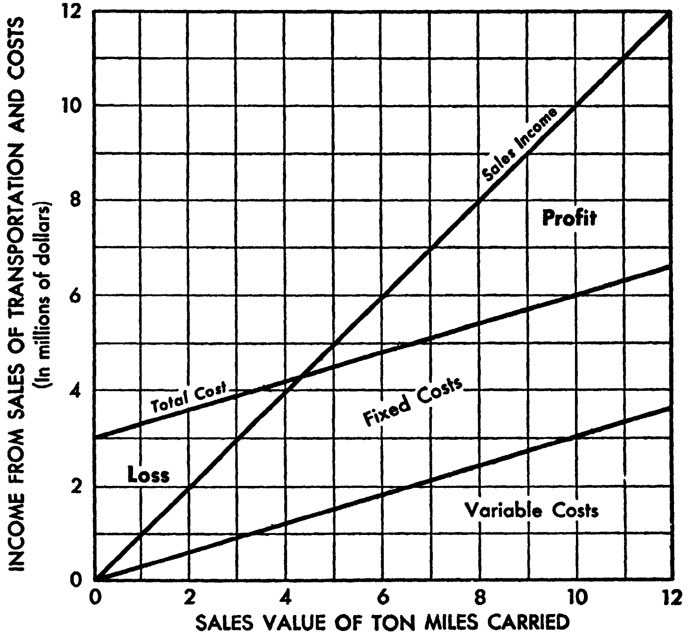

FIGURE 180. Break-Even Chart for Air Transportation Company (high marginal income ratio)

Distinction Between Marginal Income Ratio and Ratio of Net Profit to Sales. The marginal income ratio should not be confused with the percentage which net profit bears to sales. The latter ratio changes as volume varies and has a quite different interpretation. Thus, the data from the examples given above yield a ratio of net profit to sales:

$$\frac{\$1,200,000}{\$6,000,000} = 20\%$$

However, if volume rises to $7,000,000 net profit increases to $1,540,000 and the ratio of net profit to sales is:

$$\frac{\$1,540,000}{\$7,000,000} = 22\%$$

Significance of Variable Cost Ratio. In contrast to the net profit ratio, the variable cost ratio does not change within the normal range experienced by a company. Hence, once the variable cost ratio is known, the amount of variable cost that will be incurred at any volume is readily determined. For example, at a sales volume of $7,000,000 the amount of variable cost is $7,000,000 × 66% or $4,620,000 for a business whose variable cost ratio is 66%. If the volume should drop to $5,000,000, the variable cost becomes $5,000,000 × 66% or $330,000.

Significance of the Marginal Income Ratio. The marginal income ratio is also constant for any volume within the normal experienced range. It makes it possible to determine what change in profit will result from a given change in volume provided other conditions remain the same. For example, an additional order amounting to $10,000 would contribute an additional $3,400 to profits of a company having a marginal income ratio of 34%, or reduce the loss by the above amount.

The marginal income ratio also tells an important fact about the profit-making characteristics of a company. A company which has a large marginal income ratio shows a comparatively large increase in profit when sales volume increases. Decreases in sales volume have the opposite effect and even a small decline in volume would cause such a company's profits to vanish altogether. For example, the break-even chart of a company engaged in air transportation is shown in Figure 180. Here each additional dollar of sales revenue adds 70 cents to the company's net profit. Thus the company's profits rise rapidly as volume increases above the break-even point. On the other hand, a small decrease in volume results in a large drop in profits. A company with such a profit structure often finds it profitable to spend considerably more for sales promotion if volume can be increased even slightly. An alternative would be to reduce selling prices if demand for the company's product is sufficiently elastic. Both of these ideas have been tried out by air carriers.

On the other hand, an increase in volume will be of relatively little benefit to the company whose break-even chart is shown in Figure 181 because the marginal income ratio is low. Here management could do more to improve profits by efforts to reduce variable costs per dollar of sales.

Limitations of Break-Even Chart. Break-even charts of the types illustrated in Figures 177 to 180 reflect only volume of production and sales as variable factors. Hence a break-even chart is drawn on the assumption that all factors other than volume remain constant. Quite obviously there are many factors other than volume which affect the amount of profit earned. For example, there may be changes in selling prices, in mixture of products sold, and in costs, either fixed or variable or both. In actual circumstances these changes occur so frequently that it cannot be expected that a break-even chart will be more than an approximation to the company's actual profit structure. This is another reason why the chart is best drawn by use of data taken from the budget rather than from historical figures, for the budget represents the specific combination of prices, sales mix, and costs anticipated during the coming budget period while data from the accounts for previous periods usually reflect various prices, sales mixtures, and costs.

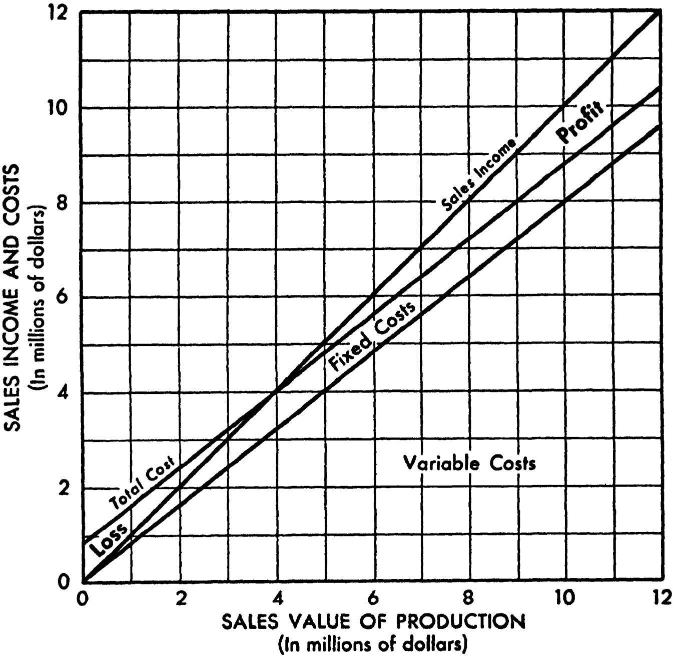

FIGURE 181. Break-Even Chart Showing Low Marginal Income Ratio

As a result of these limitations certain cautions must be observed in the use of a break-even chart. To begin with, the position of the lines on the chart is reliable only within the range of normal volume fluctuations. An extreme drop in volume causes management to cut many fixed costs. For example, executive salaries may be cut, foremen transferred to direct labor, or excess plant and equipment sold to reduce depreciation, insurance, and property taxes. By such actions, the break-even point is lowered. A large increase in volume has the opposite effect, for costs which are fixed within the normal range of volume will be increased. As examples, additional supervisors and clerks are often added and more machinery and equipment are bought. That the above statements are true can be seen in the fact that many companies continue to operate at a profit after volume declines below the break-even volume and also in the fact that profits often fail to increase as much as might be expected from the chart when volume reaches unusually high levels.

A second point to be noted is the fact that a single chart can represent only one set of conditions and new charts must be drawn when underlying assumptions change. Morever, the chart is a summarizing device and changes in details must be studied by reference to the cost, income, and profit figures.

Changes in Factors Other than Volume. Changes in factors other than volume affect the marginal income ratio and break-even point as follows:

1. A change in the amount of fixed costs changes the break-even point, but not the marginal income ratio.
2. A change in variable costs per unit of production changes both marginal income ratio and break-even point.
3. A change in selling prices changes both marginal income ratio and break-even point.
4. A change in the mixture of products sold usually affects the over-all marginal income ratio and the break-even point.

Illustrations of these statements follow. The data given below are assumed to represent the current position of a company as the basis for showing what effect a given change will have upon the profit structure of a company.[2]

Sales Volume		$6,000,000.00
Costs:		
Variable	$4,200,000.00	
Fixed	1,470,000.00	5,670,000.00
Profit		$ 330,000.00
Marginal Income Ratio		30%
Break-Even Sales Volume		$4,900,000.00

It is assumed that sales of $7,000,000 a year represent practical capacity volume for the plant. A break-even chart drawn from the above data is shown in Figure 182. Study of the chart and the figures above shows that even with operations at 86% of plant capacity (i.e., $6,000,000 ÷ $7,000,000), the company is earning only 5.5% of sales before income taxes. It has a high break-even point and a low margin of safety. The latter is calculated by taking the difference between the break-even volume and the budgeted volume and dividing it by the budgeted volume. Hence, the safety margin is:

$$\frac{\$6{,}000{,}000 - \$4{,}900{,}000}{\$6{,}000{,}000} = \frac{\$1{,}100{,}000}{\$6{,}000{,}000} = 18.3\%$$

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[2] Illustration from Charles H. Gleason, "The Breakeven Point of Operations and Profit Volume Relationship," unpublished address before New Haven Chapter. National Association of Cost Accountants, 1949. Used with permission of the author.

Should sales volume drop 20%, the company will operate at a loss. A decrease of 5% in selling prices of the company's products will very nearly wipe out profits at the current volume, as is shown below. Increases in costs would have a similar effect.

Profit-Volume Relationship—Projected 12 Months' Operations
Current Costs and Selling Prices

Margin of Income 30% Sales Value
Margin of Safety 18.3% on $6,000,000 Projected Sales

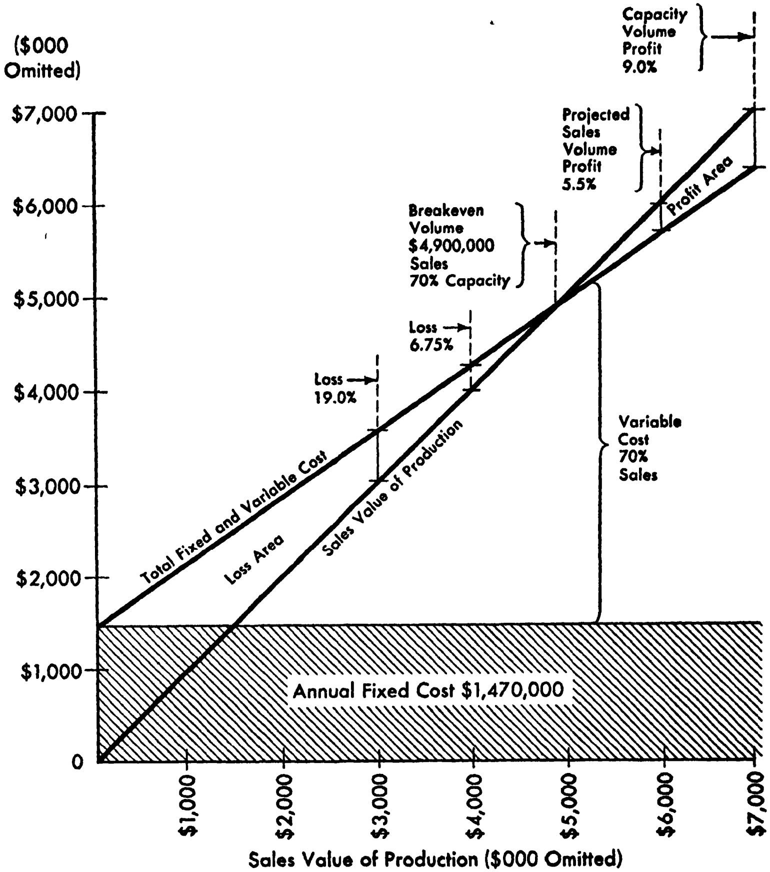

FIGURE 182. Break-Even Chart with High Break-Even Point

Effect of Reduction in Selling Prices. Since a reduction in selling prices alone does not change the physical volume of goods made and sold, costs remain the same as before while sales income decreases. The figures below and the chart in Figure 183 reflect a 5% decrease in selling price.

Sales ($6,000,000 less 5%)		$5,700,000
Costs:		
Variable	$4,200,000	
Fixed	1,470,000	5,670,000
Profit		$ 30,000

Marginal income ratio: $\frac{(\$5{,}700{,}000 - \$4{,}200{,}000)}{\$5{,}700{,}000} = 26.3\%$

Break-even sales volume: ($1,470,000 ÷ 26.3%) = $5,590,000

From the above figures it is seen that the marginal income ratio has declined while the break-even point has risen. At the current volume

Profit-Volume Relationship—Projected 12 Months' Operations

Rule 4—Change in selling price—same effect as change in variable cost.

Selling price reduced 5% =
Increase in Variable Cost to 73.7% — (70 ÷ 95)
Decrease in Margin of Income to 26.3%
Decrease in Margin of Safety to 1.9%

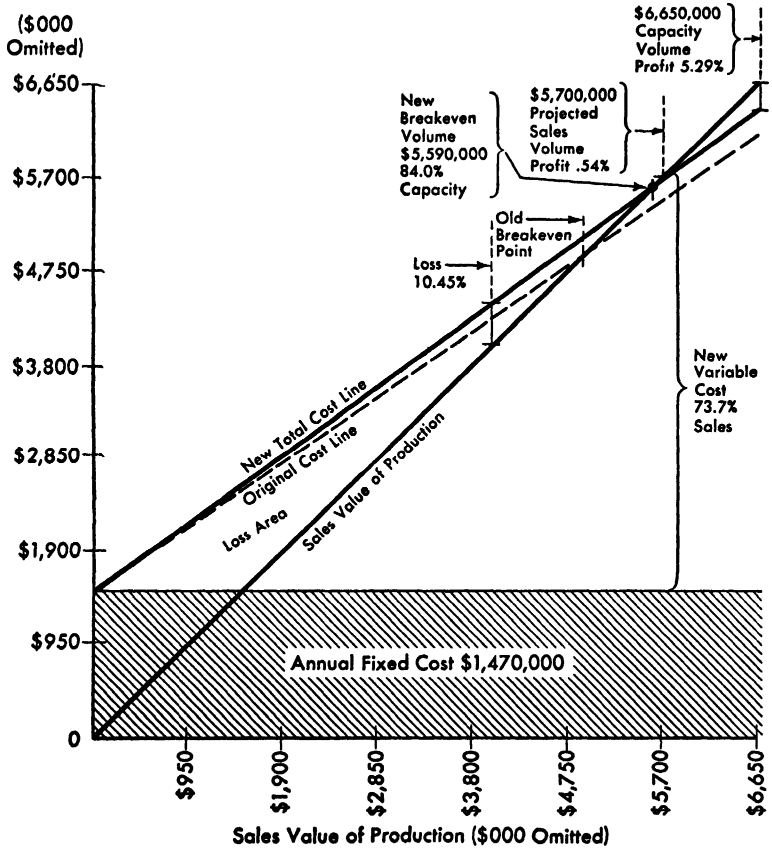

FIGURE 183. Effect of Price Reduction on Break-Even Point

the company's profits are inadequate and the marginal income ratio is so low that profits would still be unsatisfactory even if volume could be increased to plant capacity. In passing it may be noted that plant capacity is now stated at $6,650,000. This is the result of deflating the old $7,000,000 sales capacity by 5%, since the capacity figures are stated in sales dollars.

Reduction in Annual Fixed Charges. A substantial improvement in the profit position of the company in question will result if fixed costs can be reduced. A reduction in variable costs will also be helpful, although the effects are not so marked in this case. Figures 184 and 185 illustrate what can be expected to happen to the company's profit structure if such changes can be effected. An increase in selling prices would also improve profits even if it does not affect the physical volume of sales.

If a reduction in fixed costs can be made, the company's profits will increase as shown below and in Figure 184.

Sales		$6,000,000.00
Costs:		
Variable	$4,200,000.00	
Fixed	1,000,000.00	5,200,000.00
Profit		$ 800,000.00
Marginal Income Ratio		30%
Break-Even Point		$3,333,333.00

It can be seen that the profit position of the company would be distinctly improved by such a reduction in fixed cost. With sales of $6,000,000 the rate of profit on sales is 13.33%. Moreover, there exists a margin of safety of 44.5%. In other words, a drop of 44.5% in sales could take place before the break-even point is reached.

Reduction in Variable Costs. The following figures and Figure 185 illustrate the effect of a reduction in variable costs to 65% of sales from the previous 70%.

Sales		$6,000,000.00
Costs:		
Variable	$3,900,000.00	
Fixed	1,470,000.00	5,370,000.00
Profit		$ 630,000.00
Marginal Income Ratio		35%
Break-Even Volume		$4,200,000.00

Again an improvement in profits at current volume is indicated, although it is not as great as that which follows a reduction in fixed costs.

Profit-Volume Relationship—Projected 12 Months' Operations

Rule 1—Change in amount of Fixed Costs changes the break-even point of operations but not the Margin of Income ratio or the progressive rate of net profits.

Fixed Cost reduced to $1,000,000
Margin of Income 30% Sales Value
Margin of Safety 44.5% on $6,000,000 Projected Sales

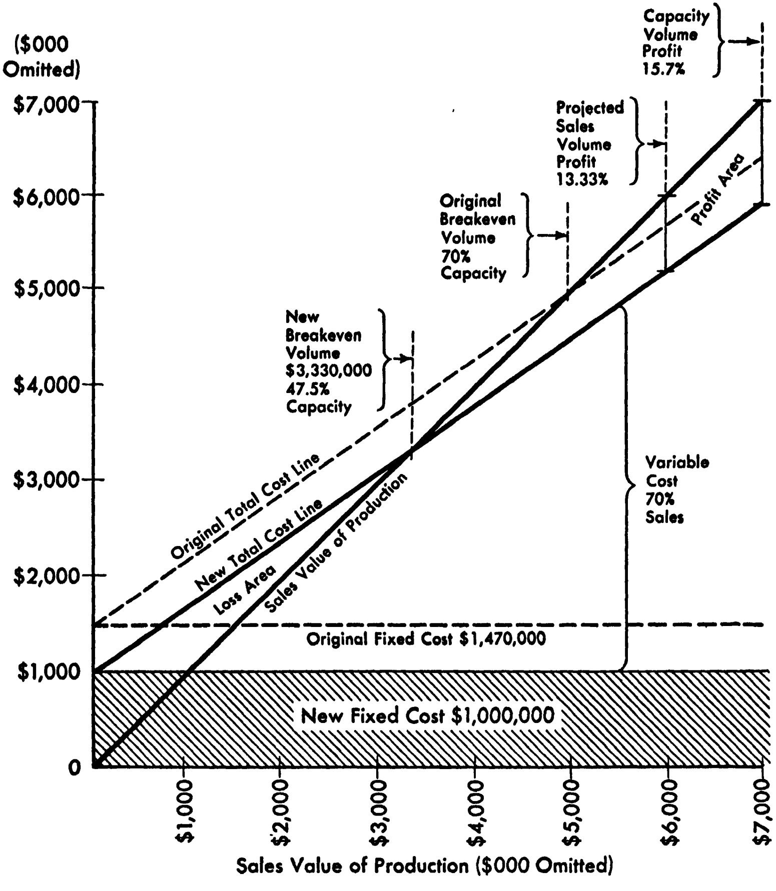

FIGURE 184. Effect of Reduction in Fixed Charges on Break-Even Point

Effect on Break-Even Point of a Shift in Mixture of Products Sold. Most companies make and sell a number of products in different sizes, models, and grades. These products or varieties are not equally profitable, for some cost more to make and sell than do others and some carry higher mark-ups than others. For this reason changes in the mixture of products sold may have a substantial effect on profits. A break-even chart can show only the over-all results from a given sales mix and therefore the effect of a change in sales mix must be studied by resort to figures which present data for individual products. Figure 186 illustrates what might happen to a company's profits if the proportion of low-margin items should increase.

Profit-Volume Relationship—Projected 12 Months' Operations

Rule 2—Change in the variable cost charges

a) The Break-Even Point
b) The Margin of Income ratio
c) The progressive rate of net profits

Variable Costs reduced to 65% Sales
Margin of Income increased to 35%
Margin of Safety 30% on $6,000,000 Projected Sales

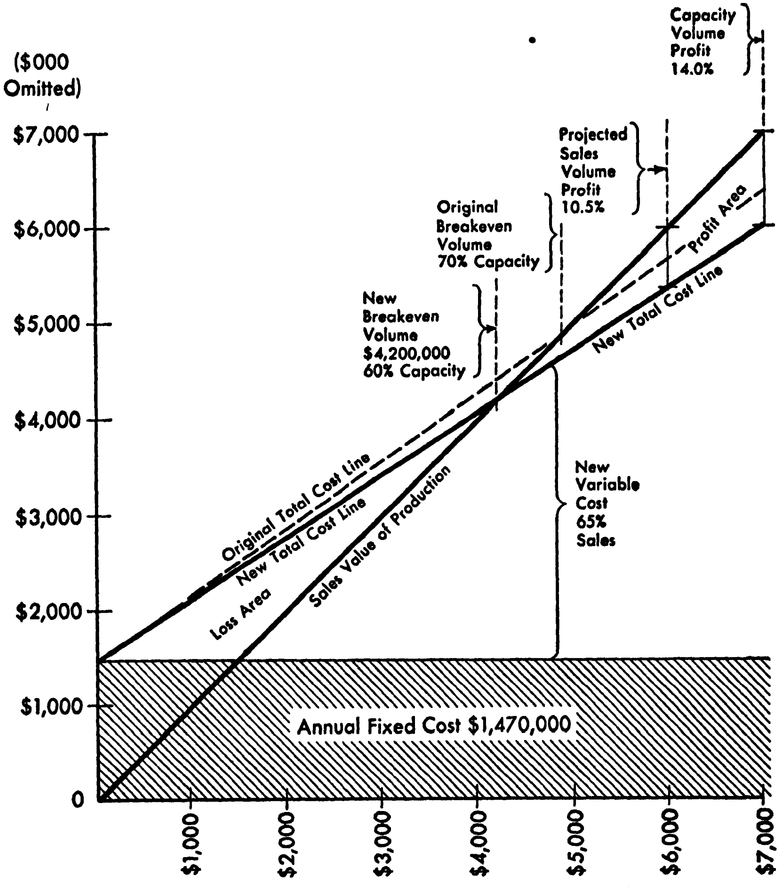

FIGURE 185. Effect of Reduction in Variable Costs

Assuming the budgeted sales of $6,000 * represent sales of four products which are expected to be sold in the mixture shown below, a profit of $630 and a break-even point of $4,200 results.

	Product				
	A	B	C	D	Totals
Sales	$2,000	$2,500	$1,000	$500	$6,000
Percentage of total sales	33⅓%	41⅔%	16⅔%	8⅓%	100%
Variable cost	1,200	1,700	800	200	3,900
Marginal balance	$ 800	$ 800	$ 200	$300	$2,100
Marginal income ratio	40%	32%	20%	60%	35%
Fixed costs					$1,470
Operating profit					$ 630
Break-even point			$\frac{\$1470}{.35} = \underline{\underline{\$4,200}}$		

If, however, sales should shift toward a larger proportion of the products carrying lower marginal income ratios, the following figures illustrate the possible results:

	Product				
	A	B	C	D	Totals
Sales	$1,500	$2,200	$2,000	$300	$6,000
Percentage of total sales	25%	36⅔%	33⅓%	5%	100%
Variable cost	900	1,496	1,600	120	4,116
Marginal balance	$ 600	$ 704	$ 400	$180	$1,884
Marginal income ratio	40%	32%	20%	60%	.314%
Fixed costs					$1,470
Profit					$ 414
Break-even point			$\frac{\$1470}{.314} = \underline{\underline{\$4,681}}$		

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* 000 omitted.

From "The Analysis of Cost-Volume-Profit Relationships," *N.A.C.A. Bulletin*, December, 1949, p. 562.

FIGURE 186. Effect of Shift in Sales Mix

Analysis of Profit Variations

At the close of a period when the income statement has been prepared it is important to compare the actual results with budgeted results. Such a comparison tells where and by how much the operating results have fallen short of, or exceeded, the planned results shown in the budget. This comparison may be made in the following form:

INCOME STATEMENT

For Year Ended . .

	Actual		Budget		
	Amount	% Sales	Amount	% Sales	Differences
Sales					
Cost of Goods Sold					
Gross Margin					
Selling and Administrative Expenses					
Net Operating Profit					

A more informative income report makes use of the principle of exceptions and provides an analysis of differences by causes. This statement does not require executives to read and compare numerous figures. Instead, it shows budgeted profits, actual profits, and the difference analyzed by causes. The detailed figures for sales, cost of goods sold, gross margin, and operating expenses are, of course, available in supplementary reports, if desired.

Sales Variances. The actual net profit figure for a period may differ from the budgeted figure because revenue was more or less than budget and because costs were above or below budget. As explained in an earlier chapter, cost variances may result from changes in volume or from variations in prices paid for goods or services, or changes in efficiency. These are analyzed in the usual manner. By contrast profit variances may be analyzed into three principal causes:

1. Changes in sales volume
2. Changes in selling prices realized
3. Changes in sales "mix"

Quite obviously the volume of goods sold affects the amount of sales income received. When the actual volume differs from the budgeted volume a sales volume variance arises. A volume variance may be computed for each item as well as for the over-all volume.

The budgeted sales figure is based upon the expectation that certain prices will be obtained for the company's products. These prices are often list prices or standard prices. Any deviations from these prices result in an actual sales income figure which differs from the budgeted sales income. Like the volume variance, a price variance may be computed for each product.

Sales Mixture Variance. Whenever the *proportions* in which individual products are sold varies from the proportion anticipated in the budget, a so-called sales mix variance results. A company which sells a variety of products usually finds that these products are not all equally profitable. Some products carry higher gross margins than other products. The reason for this is that some products may be sold in a highly competitive market while other products have little competition, some products may be more expensive to manufacture, or it may be sales policy to carry certain items which complete a line or serve as low price leaders. Similar variations may arise when the same product is sold in different markets in which transportation or other costs differ, or when the same product is sold at different prices to different classes of customers. In short, the variance occurs because the *total volume* achieved represents, as mentioned above, different proportions of individual products from those contemplated.

Procedure in Analyzing Profit Variances. In order to analyze profit variances, it is necessary to set up the expected and actual figures for sales and costs. This automatically produces expected and actual profit figures whose difference is the amount of profit to be accounted for. The analyst then proceeds to break down the sales variance (i.e., the difference between expected and actual sales). Next he does the same for the cost variance which can be analyzed in as much detail as the problem affords. In the case of material and labor quantity and price variances are obtained. In the case of overhead variances capacity and controllable variances result, the latter in turn being analyzed into efficiency and spending or budget variances. The actual cost figures are compared against the budget, not against standards for particular batches as was done in the chapter on cost variances.

When sales variances are to be analyzed, three independent variables are involved. The way to segregate each of the variables is to allow only one variable to vary at a time while holding the other two constant. As soon as that is done, however, it becomes apparent that there are several solutions to the problem. The reason for this is that the three variables—quantity, price, and mix—can be combined with each other in various ways. The total difference to be accounted for is the spread between the forecast and the actual figures. In order to obtain three variances it is necessary to have four sets of figures. The first contains only forecasted figures, the last only actual figures. The second and third sets are the ones that give trouble because each of the variables taken at actual or standard may be combined with every other variable at actual or standard. To illustrate:

Let V_f and V_a represent forecast and actual physical volume, respectively
P_f and P_a represent prices (forecast and actual)
M_f and M_a represent mix (forecast and actual)

Columnar arrangements may then be set up and will appear as shown in Figure 187. Examination of this table shows that only one quantity

					Order of Isolation		
	(1)	(2)	(3)	(4)	1st	2nd	3rd
Case I.	$V_f P_f M_f$	$V_a P_f M_f$	$V_a P_a M_f$	$V_a P_a M_a$	V	P	M
Case II.	$V_f P_f M_f$	$V_a P_f M_f$	$V_a P_f M_a$	$V_a P_a M_a$	V	M	P
Case III.	$V_f P_f M_f$	$V_f P_a M_f$	$V_a P_a M_f$	$V_a P_a M_a$	P	V	M
Case IV.	$V_f P_f M_f$	$V_f P_a M_f$	$V_f P_a M_a$	$V_a P_a M_a$	P	M	V
Case V.	$V_f P_f M_f$	$V_f P_f M_a$	$V_a P_f M_a$	$V_a P_a M_a$	M	V	P
Case VI.	$V_f P_f M_f$	$V_f P_f M_a$	$V_f P_a M_a$	$V_a P_a M_a$	M	P	V

FIGURE 187. Possible Arrangements for Analysis of Sales Mix Variances

is allowed to vary between any two consecutive columns. For example, Case I shows that any difference between columns (1) and (2) must be due to variation in volume; similarly the difference between columns (2) and (3) represents a price variance; finally, the difference between columns (3) and (4) represents the mix variance. Hence in this instance the volume variance was isolated first, price variance second, and mix variance last. As Figure 188 shows, however, it is possible to isolate the price variance or even the mix variance first. In each instance, different answers are obtained, each one mathematically correct, depending upon the order in which the variables are isolated. For the sake of uniformity Case I has been selected as the standard preferred method in the solution of problems involving analysis of sales variances.

The following problem is now presented and solved:

Forecast

	Volume		Selling Price		Cost of Sales		
Product	No. of Pairs	Per Cent of Total	Per Pair	Total	Per Pair	Total	Gross Profit
A	10,000	25%	$2	$ 20,000	$1.50	$15,000	$ 5,000
B	30,000	75	3	90,000	2.00	60,000	30,000
Totals	40,000	100%		$110,000		$75,000	$35,000
			Actual				
A	16,000	33⅓%	$3	$ 48,000	$2	$ 32,000	$16,000
B	32,000	66⅔	4	128,000	3	96,000	32,000
Totals	48,000	100%		$176,000		$128,000	$48,000

Required: Analyze the total profit variance.

Solution and Comments: The details of the solution are presented in Figures 188 and 189. As the statement of the problem shows, there is a favorable variance of $13,000 in gross profit to be accounted for; i.e., the actual gross profit exceeded the budgeted profit by that amount. In turn, the profit is itself the resultant of two forces—sales and costs. Accordingly, the favorable sales variance of $66,000 (i.e., the difference between $110,000 and $176,000) is analyzed in Figure 188, the unfavorable cost variance of $53,000 (i.e., the difference between $75,000 and $128,000) being shown in Figure 189. The difference between the sales and cost variances is seen to be equal to the gross profit variance.

In Figure 188, the figures in columns (1) and (4) are given in the problem. The figures in columns (2) and (3) are explained in Figure 188. It is to be noted that the volumes in columns (2), (3), and (4) are all the same, but that the proportions of the total differ between (3) and (4). This gives rise to the mix variance.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
					Variances			
Product	$V_f P_f M_f$	$V_a P_f M_f$	$V_a P_a M_f$	$V_a P_a M_a$	Total (1) − (4)	Volume (1) − (2)	Price (2) − (3)	Mix (3) − (4)
A . . .	$ 20,000 00	$ 24,000 00*	$ 36,000.00**	$ 48,000.00	+ $28,000.00†	+ $ 4,000.00	+ $12,000.00	+ $12,000.00
B	90,000.00	108,000.00	144,000.00	128,000.00	+ 38,000.00	+ 18,000.00	+ 36,000.00	− 16,000.00
Totals .	$110,000.00	$132,000.00	$180,000.00	$176,000.00	+ $66,000.00	+ $22,000.00	+ $48,000.00	− $ 4,000.00

* $V_a \times P_f \times M_f$
A 48,000 × $2 × 25% = $ 24,000
B 48,000 × $3 × 75% = $108,000

** $V_a \times P_a \times M_f$
A 48,000 × $3 × 25% = $ 36,000
B 48,000 × $4 × 75% = $144,000

† + = favorable
− = unfavorable

FIGURE 188. Analysis of Sales Variances

In passing it should also be noted that an increase in a sales figure is favorable (+) while an increase in a cost figure is unfavorable (−). This explains the *apparent* inconsistency between Figures 187 and 188.

The cost variances (Figure 189) are analyzed in the usual manner, so far as available figures permit. If details as to material, labor, and fixed and variable expenses were available, further analysis would be possible. The results of the two types of analysis may be summarized as follows:

Summary of Sales and Cost Variances

	Total	Volume	Price	Mix
Sales (Figure 188)	+$66,000.00	+$22,000.00	+$48,000.00	$4,000.00
Costs (Figure 189)	− 53,000.00	− 13,000.00	− 40,000.00	-
Gross Profits Accounted for	+$13,000.00	+$ 9,000.00	+$ 8,000 00	−$4,000.00

The above figures show clearly, yet simply, the degree of influence exercised by volume, price, and sales mixture on the gross profit. As to volume, there was a net increase in gross profit of $9,000, accounted for by higher revenues from increased volume ($22,000) and offset by higher costs for that volume ($13,000). Similarly, price changes added $8,000 to profits, consisting of $48,000 from higher selling prices, offset by expanding costs of $40,000. Changing sales mixture decreased profits by $4,000 because a higher percentage of low profit items had been sold.

	(1)	(2)	(3)	(4)	(5)	(6)
					Variances	
Product	$V_f P_f$	$V_a P_f$	$V_a P_a$	Total (1) − (3)	Volume (1) − (2)	Price (2) − (3)
A .	$15,000.00	$24,000.00	$ 32,000.00	− $17,000.00	− $ 9,000.00	− $ 8,000.00
B .	60,000.00	64,000.00	96,000.00	− 36,000.00	− 4,000.00	− 32,000.00
Totals ...	$75,000.00	$88,000.00	$128,000.00	− $53,000.00	− $13,000.00	− $40,000.00

FIGURE 189. Analysis of Cost Variances

QUESTIONS

1. Define break-even point; what is its relation to normal capacity?
2. Business men are not interested in just breaking even, they are concerned with producing profits. What then are the uses of break-even analysis?

3. Explain how a break-even point can be derived for a business producing more than one product.
4. What is the effect of a cut in sales price coupled with a cut in fixed costs on the break-even point?
5. "The correlation between costs and volume is sometimes obscured by time lags between incurrence of the costs and emergence of production at the point where it is measured by the index of volume used." Explain.
6. What is the usefulness of profit–volume relationship in the preparation of a budget?
7. What is the marginal income ratio and how is it related to break-even analysis?
8. If a business manufactures several products with different mark-ups and is already operating above the break-even point, which product should it push? Explain by illustration.
9. The Baer Company presents the following facts:

Present sales volume	$200,000.00
Total fixed charges	100,000.00
Variable unit cost	$ .90
Present unit selling price	$ 2.00

It is proposed to reduce the selling price to $1.80 a unit. How many units must be sold to maintain the same profit as before?

10. Explain the significance of sales mix variance as differentiated from price and quantity variances.
11. Is it ever advantageous to a company to accept orders even when the price received is not sufficient to cover the full cost of the goods sold?
12. Many businessmen justify selling some items in their line at a loss so long as a profit is made on the entire line. How can distribution cost accounting aid a business operating under that kind of a pricing system?

Chapter 27

COMPARATIVE COSTS FOR MANAGERIAL DECISIONS

Choice Between Alternatives. Costs are designed to answer questions which arise in the operation of a business enterprise. Techniques described in the preceding chapters have been developed primarily to answer the questions "What did it cost?" and "How much should it cost?" These questions call for historical costs and standard costs respectively. In each instance the question has referred to a specific product, operation, or function which serves as the costing unit. Explicitly or implicity the assumption has been made that the product named has been made or will be made.

There are, however, a great many questions which arise in the operation of a business which call for somewhat different kinds of cost data. These questions are essentially "What will happen to costs if methods of operation were changed in a certain way?" The proposed change may be the addition of a new product to the present line, replacement of a machine with a newer type, acceptance of orders at a special price, manufacture of parts now purchased, or expansion into a new sales territory. In each case it is necessary to choose between alternative courses of action. While cost is seldom the only consideration in the decisions made, it is usually an important factor. Hence it is necessary to ascertain what costs can be expected to result from each of the alternatives which have been proposed. By comparison of these costs, or by comparison of the profits after deducting costs from sales income, management can choose the course of action which promises to be most advantageous. The costs employed in such evaluation of alternative courses of action are called comparative costs. Such costs have three characteristics, viz.:

1. They are prospective or future costs.
2. They are partial costs.
3. They are obtained by special studies rather than by routine bookkeeping.

Costs of Future Actions. Since the various lines of action in question are future possibilities, the costs are prospective costs rather than actual or standard costs. While the latter may be the basis with which to start in estimating comparative costs, the fact that a proposal to change existing methods of manufacturing or selling is being considered means that the costs will differ from those experienced or from the standard under present methods. This may be illustrated by the following:

> For example, suppose the replacement of a machine tool were under consideration. The cost records would show the actual operating costs of the machine per unit of product. However, these would most likely vary from the standards which assumed a normal level of activity at average efficiency on the usual mixture of products. Certainly neither the actual nor the standard would be applicable to the new machine. Furthermore, because the contemplated replacement machine has greater capacity, it will open new fields for business and thus probably change the product mixture. Therefore, the standard costs and the actual costs which have been developed for the existing machine must be modified as to product mixture if they are to be comparable with the forecast operating costs of the new machine. Thus, in many cases, both sides of the comparison will be based on predetermined costs rather than on historical costs.[1]

Partial Costs

Need for Cost Differences. In comparing alternatives it is necessary to consider only those items of cost which are expected to differ from one alternative to another. Costs which are not affected by the choice made are not necessary in making the decision. For example, if the question is whether or not to use a more expensive grade of material in order to reduce scrap losses, such costs as the factory manager's salary, insurance, depreciation, and property taxes on the plant will probably not be changed by the decision made and can be disregarded for purposes of the comparison. When improperly included, such costs may actually be misleading and may lead management to make the wrong decision. Hence, in computing costs for decisions involving choice between alternatives, it is essential to filter out the cost elements which are irrelevant to the purpose for which the costs are wanted and to consider only those costs which are affected by the decision in question. The costs to be compared are usually referred to as differential costs. Other terms used are "marginal costs," "incremental costs," and "out-of-pocket" costs. Whatever the term employed, these costs represent the increased cost resulting from the exercise of the alternative. This increase is not incurred if the alternative is not exercised. Figure 190 presents in tabular form an illustration of differential costing and its revenue counterpart, differential income. It is assumed that the plant at present is producing

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[1] I. Wayne Keller, "Comparative Costs for Factory Management," *N.A.C.A. Conference Proceedings*, 1950, p. 66.

Lot No.	Quantity of Additional Output	Cost of Additional Output		Cumulative Average Cost per Unit	Selling Price		Profit Margin	
		Total	Per Unit		Total	Per Unit	Per Lot	Cumulative
1	20,000	$100,000.00	$ -	$5.00	$140,000.00	$7.00	$40,000.00	$40,000.00
2	5,000	15,000.00	3.00	4.60	20,000.00	4.00	5,000.00	45,000.00
3	5,000	13,000.00	2.60	4.2667	17,500.00	3.50	4,500.00	49,500.00
4	5,000	17,000.00	3.40	4.1444	15,000.00	3.00	2,000.00*	47,500.00
Totals	35,000	$145,000.00	-	$4.1444	192,500.00	$5.50	-	47,500.00

* Loss.

FIGURE 190. Differential Income and Costs

20,000 units at an average cost of $5 per unit for material, labor, and manufacturing overhead. At this point a customer offers to buy an additional 5,000 units at $4. Should it be accepted or rejected? The books show an average unit cost of $4.60 based on a total cost of $115,000 for 25,000 units. This would seem to point to outright rejection of the offer. Yet analysis shows that the additional cost of producing this lot of 5,000 units is only $15,000. This represents the *differential cost* of the added output or a differential cost of $3 per unit. Moreover far from showing a net loss, acceptance of the offer produces differential income of $5,000 and lifts the *total* profit of the business from $40,000 to $45,000.

Similarly, after an output level of 25,000 units has been reached, an offer for 5,000 additional units (lot No. 3) at $3.50 may safely be accepted, since the differential cost of that particular lot is $2.60 though the average cost for all three lots together is $4.2667. However, the offer for lot No. 4 at $3.00 should be rejected. Apparently the optimum production point has been passed and the concern is beginning to operate under conditions of increasing costs. The reason for the prospective loss on lot No. 4, however, is not because the offer is for less than the average cost to produce, but because it is less than the *differential unit cost of the added output.*

The behavior of the costs as production passes from one level to another may be shown by another illustration (Figure 191) according to which the added output may be sold at any price above the differential cost of $.5385.

	Present Costs	Cost after 20% Increase in Output	Differential Cost of Added Production
Variable			
Raw material	$1,000.00	$1,200.00	$200.00
Direct labor	2,000.00	2,400.00	400.00
Variable overhead .	500.00	600.00	100.00
	$3,500.00	$4,200.00	$700.00
Fixed overhead	3,000.00	3,000.00	-
	$6,500 00	$7,200.00	$700 00
Number of units	6,500	7,800	
Average unit cost ..	$1.00	$.9231	
Differential unit cost			$.5385

FIGURE 191. Behavior of Costs in Differential Analysis

Conclusions Concerning Differential Costs. From the above two illustrations a number of conclusions may be drawn:

1. Differential costs are always differences measured from some given position (present level of output).

2. Differential costs are not affected by costs which remain the same in total amount (fixed costs) while a change in output or some other condition takes place. In short, fixed charges are not included in differential costs.
3. The differential cost is the amount of change in those costs which do not remain the same in total amount (variable costs) when the prescribed change in conditions occurs.
4. The criterion for acceptance or rejection of additional business is whether acceptance will leave some revenue (differential income) above the differential cost. The additional business may be taken on for anything above the differential cost of the added output, even though that represents less than the average cost to produce.
5. The problem of acceptance or rejection of additional business at less than average cost arises only where there is idle plant capacity and hence unabsorbed fixed charges.
6. Differential costs are not the same at all levels. Thus in Figure 190 these costs decreased possibly because of savings in material costs through higher quantity discounts and lower transportation rates resulting from shipments in carload lots.
7. Addition of all the differential costs from zero to 100% plant capacity does not produce the total cost.

In the above illustrations differential cost was computed for a change in volume of production. However, the change need not be in production volume, for there is also a differential cost associated with a change in any other aspect of the processes of manufacturing and selling. Examples of such other changes might be addition of a sales territory, dropping of a product line, change in equipment employed, or adding a second shift.

When the change in question also affects sales income, the differential cost is compared with the differential sales income. The balance (i.e., differential income less differential cost) gives the *addition* to profit which will result. Addition is here an algebraic operation, for the result may be a negative figure. It is then interpreted as a reduction in profit rather than an addition.

Sectionalizing the Market. From what has been said above it must not be concluded that differential costing offers a quick solution to the harassed executive's perplexities. It is obvious that a business cannot sell *all* its output on a differential cost basis; some one has to pay the fixed charges and, since they are not included in the differential cost, they must be recovered in the selling price quoted to others. But marginal costing assumes that different sections of the output will be disposed of at different prices. Is this possible? The answer is a qualified affirmative. There are, first of all, legal limitations, particularly those created by the Robinson-Patman Act which restricts differences in price to demonstrated savings in the cost of manufacture, sale, or delivery. A second limitation lies in the ability of the seller to segregate or sectionalize his markets, since otherwise the price discrimination would become generally known and demanded by *all* customers. Such segregation of markets may be accomplished in various ways. A common method is to sell the same article under different brand names at different prices in the same markets or else to sell each brand in different localities. For example, certain cosmetics may be sold through specialty stores at extremely high prices while the same items under a different label, often a private brand, may be sold at greatly lower prices in some department store, and under a third label, at still lower prices, in some chain store or other mass distributing outlet.

Examples of various kinds of differential pricing are numerous. A familiar case is found in the toll rates charged by the telephone company after 6 P.M. and in other cases intended to stimulate off-peak business. The telephone company is committed to the principle of around-the-clock service. Its fixed charges for maintenance of equipment, depreciation, and taxes are high. At the end of the business day, these charges go on. It pays therefore to accept night-time business for anything above the differential cost of furnishing it. This provides marginal income and increases profits. It is to be noted, however, that the daytime user of phone service must pay the full charge which, of necessity, includes all fixed expenses.

Hotels commonly provide similar services at different price levels. Moderate priced food may be had in the hotel's coffee shop; the same food may be served at considerably higher prices in the main dining room, or in some special Blue Room or Green Room. Finally the same food may be served at extremely high prices in the banquet hall or perhaps in the hotel's night club. Each of these presents a different market, but the hotel increases its total margin by its appeal to different price levels.

The difference between ability and inability to sectionalize a market may be illustrated by the following example:

The Paragon Sweeper Company manufactures a carpet sweeper. The following information is available:

Present production	80,000
Unit cost	$18.00
Unit selling price	$15.00

It is expected that demand can be stimulated to 100,000 units by cutting the selling price to $12.50 and trying to effect economies in production that will more than offset the decline in selling price. The resulting cost of production is $15 a sweeper. Figure 192 shows the results assuming that all sweepers must be sold *in the same market.* It is to be noted that, although savings in unit production cost exceeded the drop in unit selling price by $.50, nevertheless the total result is an additional loss of $10,000. Obviously, the savings are not enough to offset the drop in revenue. To be at least as well off as before the price cut, the company must recover the differential cost of the added output at a selling price determined as follows:

Revenue on first lot (80,000 × $15)	$1,200,000.00
Differential cost on second lot ($1,500,000 – $1,440,000)	60,000.00
Total revenue to be recovered	$1,260,000.00
Unit selling price required	$ 12.60

The conclusion, therefore, must be that unless at least 100,000 sweepers can be sold in excess of $12.60 per sweeper, some other remedy for the company's dilemma must be found.

PARAGON SWEEPER CO.

Quantity	Unit Cost	Total Cost	Unit Selling Price	Total Selling Price	Profit or (Loss)	Differential Cost	
						Total	Unit
80,000	$18.00	$1,440,000	$15.00	$1,200,000	($240,000)	–	–
100,000	15.00	1,500,000	12.50	1,250,000	(250,000)	$60,000	$3.00
Additional loss by increasing production					$ 10,000		

FIGURE 192. Expanding Output—Entire Product Sold in Same Market

Such a remedy may possibly be available if the company's market can be sectionalized. In that case the first 80,000 sweepers can be disposed of through the usual channels; but the additional 20,000 sweepers can be sold for anything above the differential cost of $3 per sweeper. Suppose a price of $10 for the second batch is set. The results would then appear as follows:

Loss on 80,000 sweepers		$240,000.00
Differential cost of 20,000 sweepers	$ 60,000.00	
Differential revenue of 20,000 sweepers	200,000.00	
Net differential income		140,000.00
Net loss		$100,000.00

It is evident, therefore, that the company's operating results can be substantially improved if market segregation is possible.

Shutdown vs. Operation at Loss. It often happens that, because of a changing economic environment, the demand for a company's product decreases and also the market value of the product falls. In such cases the management may consider the possibility of a temporary plant shutdown as against continued operation at a loss. The example below illustrates the factors involved.

The Empire State Company manufactures a silk specialty which it has marketed at $1.25 per unit. Because of the universal demand for nylon and other synthetic textiles, the demand and hence the selling price for silk has fallen. The company is trying to develop a new product, but in the meantime is faced with the alternative of shutting down completely or operating at a loss. On the basis of the figures below what should be the decision?

1. Standard capacity	
a) Quantity	200,000 units
b) Production costs	
(1) Variable (material, labor, and variable expense)	$.70 per unit
(2) Fixed	$40,000
2. Estimated new selling price	$.90
3. It is estimated that 150,000 units can be sold at the above new price.	

Solution: If 150,000 units are to be marketed, the plant will operate at 75% of standard capacity. The results may therefore be summarized as follows:

Loss at zero capacity (representing fixed charges)		$40,000.00
Differential income (150,000 × $.90)	$135,000.00	
Differential cost (150,000 × $.70)	105,000.00	
Net differential income		30,000.00
Loss at 75% capacity		$10,000.00

Since it is a question of operating at zero or at 75% of capacity, the differential costs and income are measured at the 75% level. The answer appears to be that, although there is still a loss at 75% of capacity, it is much smaller than at zero capacity. In the former case, the bulk of the fixed charges (75% of $40,000) is absorbed in product cost. This cost would still go on without any absorption into product if the plant were shut down completely.

Special Studies

Procedure in Comparative Cost Studies. Since each decision involves some change from the present ways of doing things, the costs must be arrived at by special study, tailor-made for the occasion. Costs recorded in the accounts are useful in so far as the conditions expected will be like those prevailing in the past. However, where the proposed decision involves modification in methods of production or marketing, costs recorded in the books must be adjusted to reflect all changes anticipated. The following steps in making comparative cost studies therefore become necessary:

1. Defining the problem
2. Determining what costs (and in some cases income sources) will be affected by the proposals in question
3. Estimating the costs (and related income)
4. Comparing the costs (and related income)

Importance of Defining the Problem. A clear statement of the proposed course of action is necessary before its costs can be determined. For example, if the question concerns the cost of increased production, the cost of the added product will likely be different for 10,000 units and for 100,000 units. Likewise it makes a difference whether the additional output is required at a time when operations in the plant are already at 80% of practical capacity or at 100% of capacity. Knowing whether new and faster machinery will be purchased or the old equipment used may be essential in estimating costs. Occasionally a clear statement of the facts surrounding a proposal automatically shows what course of action should be taken making comparison of costs and income figures unnecessary. As an illustration, replacement of old machines was suggested in a certain company as a means to reduce high repair and maintenance costs. However, inspection of sales figures for the product made on the machines showed that sales were steadily declining and, in the opinion of the sales manager, it would soon be desirable to discontinue the product. Hence, it was decided to use the old machines until the product was dropped since it obviously was undesirable to buy new equipment which would soon be useless. Until the question has been clearly defined, the costs cannot be determined.

Determining What Costs Are Needed. The next step is to decide what costs are needed. Most proposals involve a change in some, but not all, existing conditions under which costs are incurred. For example, the proposed addition of a new product to the present line may require some new equipment such as tools and dies, but does not substantially alter the operation of factory service departments such as power, heating, and lighting, or cost accounting. Some of these existing costs will be changed (for example, additional power may be used) while others may be unchanged (e.g., occupancy costs where no additional space is needed). Hence it is best to begin by a screening of present costs to determine which ones will be changed and which ones will be unaffected. New items of cost (e.g., the costs of new tools and dies) can then be added. The result of this step is a list of those costs which will be affected if the proposed change is made.

In some cases costs outside the company must be considered. As an illustration, a company wished to determine whether to sell to customers in a given sales territory through wholesalers or to sell directly through its own salesmen. Here it was necessary to determine what gross margin the wholesalers would need to cover their costs and profit in order to decide whether or not the same functions could be performed more cheaply by the manufacturer's own sales organization.

In other instances, items not ordinarily treated as manufacturing or marketing costs may have to be included in the comparison. Interest on capital invested is one of these items. An example of a decision in which interest is an essential element of cost is furnished by a company engaged in production and refining of petroleum. This company wished to compare the costs of owning and operating its own tankers with the cost of chartering ships to transport oil. Ships of the type desired required an investment of approximately $5,000,000 each whereas no investment would have to be made if ships were chartered. Comparison of ship operating costs with charter rates did not reflect the costs associated with capital investment. To the extent that such capital is borrowed, the interest represents a recurring cash outlay much like insurance or other fixed charges accompanying ownership of the ships. If the capital is supplied by the owners of the ships, the opportunity to earn a return on these funds by investment in some other way is lost. Unless the savings in operating costs that go with ownership are greater than the return obtainable by use of the capital in some other way, it will not be profitable to purchase the ships. Hence, in such comparisons, interest on the investment required must be included with other costs.

This does not mean that interest on investment will be accounted for as an operating cost after the decision to invest has been made. Inclusion of interest with operating costs is necessary only when comparing alternatives which involve different investments. Under such circumstances interest measures the difference in costs of capital needed. Once a decision has been reached and an investment made (in ships, for example), there is no longer need for comparative costs. The owner of the equipment does not then have an alternative use for his capital. Instead he must look to the excess of income over operating costs, i.e., the profit determined by conventional methods of accounting, to provide a return on his investment. Hence the profit, or return on invested capital, is treated as a residual, rather than an operating cost in accounting for operations of the company. Interest paid on borrowed money is, of course, accounted for in the usual way as a nonoperating or financial management expense.

The rate of interest employed for determining comparative costs must be set by judgment. Ordinarily it should be the rate which could be earned by the best alternative use of the capital. A common practice is to use the average rate earned by the company on its invested capital.

Other costs ordinarily included in the accounts may not be needed for purposes of the comparison being made, or the basis on which they are determined may need to be changed. Depreciation on present equipment often should be omitted from the comparative costs when considering replacement of such equipment. In order to make the decision management needs to compare the future costs of production using the present equipment, with future costs using the proposed new equipment. Depreciation on present machines does not require any future expenditure whether or not the replacement is made. Instead, charges for depreciation on the present equipment reflect an expenditure made in the past which does not affect the amount which will have to be spent to operate the machines in the future.

Measuring Differential Cost and Income. After the needed costs have been determined, the next step is to estimate the amounts of the costs. Some decisions are made by comparing costs alone, but often the decision is based upon comparison of profits and then it is necessary to estimate the income figures as well as the costs associated with each of the courses of action being considered.

Costs for comparison should first be estimated as totals rather than developed as unit costs. Comparisons on an annual basis are usually preferred to a monthly basis since short-term fluctuations are thereby averaged out. Unit costs can be determined if desired after annual costs have been ascertained. Engineering and production departments usually prepare the detailed plans and do much of the work involved in preparing cost estimates.

Plans which call for increasing the volume of goods sold need to be checked against estimates of the potential market and of prices which can be obtained. In one instance a proposal to replace present machinery with newer machines was found to require a volume of production which exceeded the combined sales of all companies in the market in order to realize the cost savings necessary to justify the replacement.

Illustrations of the use of comparative costs comprise the remainder of this chapter. They include:

1. Analysis of historical costs to discover opportunities for improvement
2. Adding a new product to the line
3. To sell or process further?
4. Price to pay for a raw material

5. Make or buy
   a) When present operation is below capacity
   b) When present operation is in excess of standard capacity
6. Acceptance or rejection of business at a given price
7. Selection of equipment

Analysis of Historical Costs to Discover Opportunities for Improvement. The sales income of most companies is made up of numerous individual sales transactions with many customers who often are scattered over a wide geographic area. The company may also sell a variety of different products and services. Under such circumstances the company's income statement shows only total sales, total costs, and net profit from all customers and products combined. This over-all statement is, of course, appropriate in reporting to stockholders and in giving management a summary of operations for the period. However, an analysis of over-all profit ordinarily shows that some customers, sales territories, or products are much more profitable than others. When such an analysis is made for the first time, management is frequently surprised to find that a comparatively small number of the company's customers provide most of the profits. Likewise, some products are commonly sold at a loss while other products yield substantial profit margins. In order to direct efforts into the most profitable channels, management needs to know the relative profitability of customers, sales territories, or products. It also needs to estimate what the effect will be on profits if a proposed change of some sort is made in methods of operation.

The type of income statement which is most useful to internal management for the purpose of evaluating the profitableness of individual products, sales territories, customers, etc. differs somewhat from that prepared for the company as a whole, as may be seen by reference to Figure 193. In this statement variable costs of manufacturing and of selling each product are deducted from the sales income for that product. The result is a marginal income representing the contribution which that product makes toward covering the fixed costs and profit for the company as a whole. The fixed costs are not allocated to individual products for two reasons, first, because many are joint costs which must be allocated on arbitrary bases and secondly, because the fixed costs will not be changed in total amount by changes in volume of sales of individual products.

In the statement illustrated, it can be seen that Product C shows, percentagewise, the highest marginal income—i.e., 40% in comparison with 15% and 33⅓% respectively for Products A and B. Every added dollar of sales obtained by selling Product C will therefore add 40 cents to profit while a dollar of sales from Product A will add only 15 cents. Hence it is readily seen that efforts to expand sales through advertising, sales promotion, and selective selling should emphasize Products B and C rather than Product A. On the other hand, management may ask what action can be taken to make Product A more profitable. For some reason variable manufacturing costs of this product are higher than for either of the other products (i.e., 70% of sales in comparison with 40% of sales for the other products). This may be due to conditions inherent in the product, or it may reflect something in manufacturing methods or product design which could be changed to reduce costs.

OPERATING STATEMENT

For the Year Ending . . .

	Product A	Product B	Product C	Total
Sales	$100,000.00	$75,000.00	$40,000.00	$215,000.00
Variable costs of manufacturing	70,000.00	30,000.00	16,000.00	116,000.00
Manufacturing margin	$ 30,000.00	$45,000.00	$24,000.00	$ 99,000.00
Variable costs of selling	15,000.00	20,000.00	8,000.00	43,000.00
Marginal income	$ 15,000 00	$25,000.00	$16,000.00	$ 56,000.00
Contribution as per cent of sales	15%	33⅓%	40%	
Fixed costs — manufacturing, selling, and administration				35,000.00
Net profit				$ 21,000.00

Figure 193. Operating Statement on Marginal Income Basis

An interesting analytical report was prepared by one company to measure the profit yielded by adding salesmen to a territory (Figure 194). As the number of salesmen increased from one to two, the increase in profit is $1,516; addition of a third salesman increased profit by only $416. Adding the fourth salesman resulted in a sharp decrease in profit in the amount of $1,476.

Usually a definite answer to questions raised above cannot be given from the statement alone. Statements such as those illustrated in Figure 193 merely show how much each product contributes toward fixed costs and profits. But when these facts are known, management can more intelligently direct its efforts toward finding alternatives which will improve profits. This is well illustrated in Figure 195 which indicates some results yielded by comparing four different channels of distribution and allocating to these channels the variable production and distribution costs. The company in this case, a manufacturer of industrial and consumer goods, had suspected that sales in channel D were not profitable but the fact that sales in channel C were just about equal to out-of-pocket costs came as a revelation, especially since the year during which

RELATIONSHIP BETWEEN NUMBER OF SALESMEN PER TERRITORY AND PROFITS IN 12 COUNTRY TERRITORIES

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
		Gross Margin			Variable Expense			
Number of Salesmen	Sales Volume, Units of Product	Per 100 Units of Product	Amount (2)×(3)	Salary at $3,000 per Salesman	Per 100 Units of Product	Amount (2)×(6)	Total Salary plus Variable Expense (5)+(7)	Balance for Covering Fixed Expense and for Profit (4)−(8)
1	640,000	$1.00	$6,400	$3,000	$ .17	$1,088	$4,088	$2,312
2	1,260,000	.95	11,970	6,000	.17	2,142	8,142	3,828
3	1,720,000	.95	16,340	9,000	.18	3,096	12,096	4,244
4	2,080,000	.90	18,720	12,000	.19	3,952	15,952	2,768
Increase with fourth salesman (4)−(3)	360,000	–	2,380	$3,000	–	$ 856	3,856	*−$1,476

* Decrease.

FIGURE 194. Profit Contribution Resulting from Increased Sales Effort

the analysis was made was a year of high sales volume. The results of the analysis and the changes in distribution channels resulting were described as follows:[2]

> We turned our attention to customers in channel D first. An extensive study, including a similar distribution cost analysis by customer-volume groups within this channel, convinced us that there was nothing we could do to make these customers profitable. Even the larger customers in this channel were unprofitable. Therefore, we decided to eliminate this entire channel of distribution, since it was responsible for an actual out-of-pocket loss at any anticipated level of sales volume. By dropping this channel we figured to save $250,000 in out-of-pocket variable costs, while losing only $200,000 in sales . . .
>
> Next we turned our attention to customers in channel C. We classified them into groups according to the amount of their purchases, and by allocating the variable costs to each group, we found that the large customers were earning a profit margin over their variable costs. This analysis indicated that class C customers purchasing under $10,000 were the ones who caused the unfavorable showing for the entire group. They were responsible for an out-of-pocket loss of $58,900. On the other hand, customers in channel C buying over $10,000 in 1946 turned in a profit margin (before nonvariable costs) of $57,680.
>
> The next step was to review with our salesmen every single class C account in the under-$10,000-annual-volume-group and to cull out all those whose future potential did not promise to make them profitable. This review called for the elimination of about $150,000 in sales and approximately $205,000 in out-of-pocket or variable costs, thereby adding $55,000 to net profits on an annual basis.
>
> These planned changes in our channels of distribution called for an increase

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[2] U. S. Department of Commerce, *How Manufacturers Reduce Their Distribution Costs.*

SALES, VARIABLE COSTS, AND PROFIT MARGINS BY CHANNELS OF DISTRIBUTION

A. BEFORE CHANGES IN CHANNELS

Channels of Distribution	Sales	Variable Costs [1]	Marginal Income	Per Cent of Sales
A	$ 750,000	$ 400,000	$ 350,000	47
B	250,000	100,000	150,000	60
C	300,000	300,000	–	–
D	200,000	250,000	[2]—50,000	[2]—25
Total	$1,500,000	$1,050,000	$ 450,000	30
Less: Nonvariable expense	–	–	300,000	–
Net profit	–	–	$ 150,000	10

B. ESTIMATED EFFECT OF CHANGES IN CHANNELS

Channels of Distribution	Sales	Variable Costs [1]	Change in Net Profit
C	[3]—$150,000	—$205,000	$ 55,000
D	[3]— 200,000	— 250,000	50,000
A and B	[4] 100,000	85,000	15,000
Total	—$250,000	—$370,000	$120,000

C. AFTER CHANGES IN CHANNELS

Channels of Distribution	Sales	Variable Costs [1]	Marginal Income	Per Cent of Sales
A	$ 825,000	$415,000	$410,000	50
B	315,000	130,000	185,000	59
C	120,000	110,000	10,000	8
Total	$1,260,000	$655,000	$605,000	48
Less: Nonvariable expense	–	–	310,000	–
Net profit	–	–	$295,000	23

[1] Production plus distribution costs.

[2] Loss.

[3] Eliminated.

[4] Added.

Source: U. S. Department of Commerce, *How Manufacturers Reduce Their Distribution Costs.*

FIGURE 195. Report Based on Channels of Distribution

in our net profits by eliminating losses. But they would also leave us with the same dollar fixed cost which would be larger relative to a smaller total sales volume. In other words, the elimination of $350,000 of unprofitable sales would leave us with idle manufacturing and distributing capacity.

Therefore, our next step was to plan to utilize this idle capacity by increasing our sales pressure on the profitable accounts in channels A, B, and C. Of course, we realized that this increase in sales could not be accomplished in one year, and it could not be obtained without added out-of-pocket expenditure for sales promotion. Accordingly, in order to increase the number of calls on profitable customers and prospects in our remaining channels of distribution, our plan for the first year called for the retention of two of the salesmen who had been calling on unprofitable customers in channels C and D. We planned to obtain during the first year an increase of $100,000 in sales in channels A and B with a profit margin of $50,000 and added expenditures of $35,000 for sales promotion, leaving an increase of $15,000 in net profit.

Adding a New Product to the Line. The Specialty Manufacturing Company produces a single product which is here called Product A. The company's income statement for the most recent month appears in Figure 196*a*. The company is now operating at only 80% of practical capacity and unabsorbed overhead in the amount of $15,000 appears on the statement.

	Per Unit		Total	
Sales, 80,000 units of Product A		$2.75		$220,000
Cost of Production				
Direct Material	$ .50		$ 40,000	
Direct Labor	.50		40,000	
Manufacturing Overhead (applied)	1.00		80,000	
Total Cost of Goods Manufactured		2.00	$160,000	
Underabsorbed Manufacturing Overhead			15,000	
Cost of Goods Sold				$175,000
Gross Margin				$ 45,000
Selling and Administrative Expense				18,200
Net Profit				$ 26,800

FIGURE 196*a*. Profit and Loss Statement at 80% of Capacity

The overhead is applied at a standard rate of $2 per direct labor hour. This rate is based upon a practical capacity of 50,000 direct labor hours and a budgeted total overhead cost of $100,000 per month. Since each unit of Product A requires .5 hour of direct labor, the standard overhead cost per unit of product is $1. However, overhead at a volume of 50,000 hours is assumed to be composed of $75,000 fixed expense and $25,000 variable expense, and the flexible standard for cost control purposes is $75,000 a month plus $.50 per direct labor hour, or $.25 per unit of product. Assuming no variances from standard, the actual overhead at a volume of 40,000 direct labor hours (80% of capacity) is

$75,000 + ($.50 × 40,000) = $95,000. Only $80,000 has been applied to production during the past month and hence there is an underapplied balance of $15,000.

	Per Unit	Total	
Sales, 40,000 units	$1.75		$70,000
Cost of Production			
Direct Material	.35	$14,000	
Direct Labor	.50	20,000	
Manufacturing Overhead	1.20 [1]	48,000	
Total Manufacturing Cost	$2.05		82,000
Gross Loss			$(12,000)
Selling and Administrative Expense			5,600 [2]
Net Loss			$(17,600)

[1] Applied at the established standard rate of $1.00 per unit plus $.20 per unit for added overhead ($8,000 ÷ 40,000).

[2] Applied as a percentage of sales determined by dividing total selling and administrative expense by total sales:

$$\frac{\$18,200 + \$5,000}{\$220,000 + \$70,000} = 8\%.$$

FIGURE 196*b*. Cost of New Product Figured in Conventional Manner

	Per Unit		Total
Sales, 40,000 units of Product B		$1.75	$70,000
Differential Cost of Production			
Direct Material	$ .35		
Direct Labor	.50		
Manufacturing Overhead	.45 [1]		
Total Differential Manufacturing Cost		1.30	52,000
Gross Margin		$ .45	$18,000
Sales Promotion Expense			5,000
Net Profit			$13,000

[1] Made up as follows:

Variable cost per unit	$.25	
Added cost of new product ($8,000 ÷ 40,000)	.20	$.45

FIGURE 196*c*. Cost of New Product Figured on Differential Cost Basis

	Per Unit	Total	
Sales, 40,000 units	$1.75		$70,000
Cost of Production			
Direct Material	.35	$14,000	
Direct Labor	.50	20,000	
Manufacturing Overhead	.941667	37,667	71,667
Gross Loss			$(1,667)
Selling and Administrative Expense (8% of sales)			5,600
Net Loss			$(7,267)

FIGURE 196*d*. Cost of New Product Figured by Recalculating Manufacturing Overhead Rate

The company is anxious to improve the utilization of its plant in order that the loss from underapplied overhead may be eliminated. In order to do this, it is considering adding to its present line of products a new item, Product B, which can be made in the present plant with the addition of some new equipment. This new equipment will increase overhead costs by $8,000 a month. The sales department reports that it can reasonably expect to sell 40,000 units of Product B at a price of $1.75 per unit if $5,000 is allowed for advertising and promoting the new item. After a study to estimate the manufacturing costs of Product B, the statement presented in Figure 196*b* was prepared.

The calculation presented in Figure 196*b*, though it follows conventional costing technique, seems on second thought to be in error. This error results from the failure to realize that costing methods suitable for one purpose are not necessarily suitable for another purpose. Being accustomed to the accumulation of costs for costing inventories and sales, the accountant may fail to recognize the need for differential costs when a decision between alternatives is to be made. Figure 196*c* is therefore offered as being more in harmony with the existing conditions.

Manufacturing costs shown in Figure 196*c* were estimated as described below:

1. Direct material cost is determined by taking current prices of items contained in the manufacturing bill of materials prepared for Product B.
2. Direct labor cost is determined by estimating the time to perform the required manufacturing operations. This time, totaling .5 hour, is extended at the current labor rate of $1.00 per hour.
3. Overhead cost is determined by estimating the additional overhead which will be incurred if Product B is manufactured in addition to Product A. Reference to the flexible overhead standards shows that the present overhead is made up of $75,000 monthly fixed expense plus variable expense of $.50 per direct labor hour. Increasing volume by 20,000 labor hours per month will not affect the present fixed overhead, but will increase variable overhead by $10,000, or $.25 per unit attributable to the new product. The added overhead expense amounting to $8,000 per month is wholly chargeable to the new product and, on a unit basis, amounts to $.20. Differential overhead cost of the new product is thus $.45 per unit.

The above data, shown in Figure 196*c*, indicate that by incurring additional costs of $57,000, the company can increase sales income by $70,000 a month, thereby increasing profits by $13,000. Addition of the new product thus promises to yield a fairly substantial increase in profits. Obviously this calculation is decidedly at variance with the preceding one.

A somewhat different numerical result can be obtained by recalculating the rate at which manufacturing overhead is applied. Following the method ordinarily employed when establishing an overhead rate for costing production, a new overhead rate might be set by dividing the total number of direct labor hours into total overhead, each figure being after addition of the new product.

Total monthly overhead is made up as follows:	
Fixed charges	$ 75,000.00
Variable expenses	
Product A, 40,000 hrs. at $.50	20,000.00
Product B, 20,000 hrs. at $.50	10,000.00
Additional overhead for new equipment	8,000.00
Total revised overhead	$113,000.00

Total labor hours are evidently 60,000. Hence the new overhead rate is

$$\frac{\$113{,}000}{60{,}000} = \$1.883333 \text{ per labor hour or } \$.941667 \text{ per unit of product}$$

The result obtained when this new rate is applied in calculating expected profit on Product B is presented in Figure 196*d*.

Calculations in Figures 196*b* and 196*d* above are really incomplete, for they must be carried out to the point where the net profit from both products combined is determined. When this is done, the increase in combined net profit is found to be the same as that attributed to Product B when calculated on a differential cost basis. For example, using the conventional method illustrated in Figure 196*b*, the combined figures are worked out in Figure 197*a*. It is evident that since the company will work in excess of standard capacity if manufacture of Product B is undertaken there will be overabsorption of manufacturing overhead. This is revealed in Figure 197*a*. The vital point to be noted, however, is that unless the effect on total profit from both products together is considered, the conventional method does not give a correct answer to the question "What will Product B add to the profits of the company?" The separate figures seem to indicate that Product B will be carried at a loss, but overall profits can be increased by adding Product B nevertheless.

In a similar manner, the illustration shown in Figure 196*d* likewise needs to be carried out to show what profit will be realized from combined production of Products A and B. This has been done in Figure 197*b*. Again it is seen that the increase in profit which results from producing the two products together is the same as that yielded by the differential cost approach. However, in the above example, Product B has been charged with some of the fixed overhead previously borne by Product A. As a result, costs of producing A have declined. The shift in overhead cost has been effected by charging both products with an average share of the total overhead. Simple arithmetic shows that the average actual overhead rate per hour has declined from $2.375 to $1.883 per labor hour.

Unlike the conventional method in Figures 196*b* and 197*a*, this method may, under appropriate circumstances, give a correct picture of the profitability of individual products. However, it does so only by a laborious process while the differential cost approach gives this information directly and with much greater ease.

	Product A	Product B	Total
Sales	$220,000.00	$ 70,000.00	$290,000.00
Cost of Production			
Direct Material	$ 40,000.00	$ 14,000.00	$ 54,000.00
Direct Labor	40,000.00	20,000.00	60,000.00
Manufacturing Overhead	80,000.00	48,000.00 [1]	128,000.00
Standard Cost of Production	$160,000.00	$ 82,000.00	$242,000.00
Gross Profit or (Loss)	$ 60,000.00	$(12,000.00)	$ 48,000.00
Selling and Administrative Expense (8% of Sales)	17,600.00	5,600.00	23,200.00
Operating Profit	$ 42,400.00	$(17,600.00)	$ 24,800.00
Add Overabsorbed Overhead			15,000.00 [2]
Net Profit			$ 39,800.00

[1] 40,000 units at $1.20.

[2] Calculated as follows:

Total manufacturing overhead when Product A is produced by itself		$ 95,000.00
Additional manufacturing overhead incurred when Product B is added (See Figure 196c)		18,000.00
Total manufacturing overhead to produce both products together		$113,000.00
Overhead applied to Product A	$80,000.00	
Overhead applied to Product B	48,000.00	
Total overhead applied to production		128,000.00
Overapplied balance		$ 15,000.00

FIGURE 197*a*. Combined Results Applying Conventional Cost Technique

	Product A	Product B	Total
Sales	$220,000.00	$70,000.00	$290,000.00
Cost of Production			
Direct Material	$ 40,000.00	$14,000.00	$54,000.00
Direct Labor	40,000.00	20,000.00	60,000.00
Manufacturing Overhead	75,333.00	37,667.00	113,000.00
	$155,333.00	$71,667.00	$227,000.00
Gross Profit or (Loss)	$ 64,667.00	$(1,667.00)	$ 63,000.00
Selling and Administrative Expense	17,600.00	5,600.00	23,200.00
Net Profit	$ 47,067.00	$(7,267.00)	$ 39,800.00

FIGURE 197*b*. Combined Results Applying New Manufacturing Overhead Rate

There are, of course, some precautions to be exercised in using the differential cost technique. The latter implicitly assumes that fixed overhead costs will continue at the same amount for each month regardless of whether or not Product B is manufactured. However, the following situations may cause this assumption to be questionable:

1. The plant was operating at only 80% of practical capacity when the question of adding Product B was raised. If sales of Product A are only temporarily depressed, subsequent recovery may make it necessary to use the full capacity of the plant for Product A. This is likely to require expansion of the plant if Product B is continued in production. Additional fixed costs attributable to B will then be incurred.
2. Additional usage of plant facilities may shorten their life and make replacement necessary at an earlier date. The effect of this is to increase the amount of depreciation which should be charged monthly. If this is the case, this additional depreciation and any increased maintenance and repair costs are properly costs of Product B and may therefore be considered for the particular situation in question as variable.
3. Administrative and selling expenses often show some increase as volume of business increases.

The conditions listed above usually require some time to become evident. Hence, Product B can probably be produced more cheaply as a temporary measure than it can if it is to be a permanent addition to the company's product line. The differential cost computation illustrated may be reasonably accurate from the short-range point of view, but from the long-range standpoint, it may be more realistic to charge Product B with an average share of the fixed costs associated with all facilities used in producing and selling it.

To Sell or Process Further? In some industries it is frequently possible to sell a product at one or more different stages in the process of manufacturing. For example, the meat packer can sell fresh hams or he can process them into smoked hams before selling. An integrated cotton textile company has spinning, weaving, and finishing mills and sells or buys at any of these stages according to its needs for material in subsequent processes and the profit margins currently available at the various stages. The following illustration is taken from a petroleum refinery.[3]

An oil refiner has on hand 20,000 gallons of fuel oil. He must decide whether to sell it as fuel oil or crack it into gasoline and residual oil with a yield of 15,000 and 3,000 gallons, respectively. The current price of fuel oil is 7 cents per gallon, of gasoline 14 cents per gallon.

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[3] John L. Fox, "Cost Analysis Budget to Evaluate Operating Alternatives for Oil Refiners," *N.A.C.A. Bulletin*, December, 1949.

The first step is to determine the differential income; i.e., the difference between the potential revenue from sale of his material after conversion into gasoline and residual oil and its sale in the present form as fuel oil.

DIFFERENTIAL INCOME COMPUTATION

Potential revenue from cracking:	
Gasoline, 15,000 gals. at $.14	$2,100.00
Residual Fuel Oil, 3,000 gals. at $.07	210.00
	$2,310.00
Less potential revenue from sale as fuel oil:	
Fuel oil, 20,000 gals. at $.07	1,400.00
Differential income	$ 910.00

Next the differential cost is determined. This is the cost of cracking the fuel oil. Since such problems arise frequently, an analysis of costs of operating the cracking department has been made and is now available. In this analysis costs are separated into fixed and variable components and changes in variable costs with changes in volume are shown (Figure 198).

If it is assumed that the cracking department is currently operating at 80% of its standard capacity, it is evident that the differential cost of processing an additional 20,000 gallons is 5 cents per gallon, or $1,000 in total (Figure 198).

Comparing the differential cost of cracking with the related differential revenue, it is seen that it is preferable to sell the fuel oil in its present state rather than processing it further.

Differential income	$ 910.00
Differential cost	1,000.00
Potential loss from cracking fuel oil	$ (90.00)

Price to Pay for Raw Material. The question is frequently raised as to what constitutes the maximum price one can afford to pay for raw material. This is particularly the case where established selling prices are the rule. Here the manufacturer may work back from the selling price and deduct from it in succession the desired profit, the operating expenses, the manufacturing overhead, and the direct labor. This would leave a residual value representing the amount available for raw material. An alternative method is again to have recourse to differential costing. The following illustration is taken from a petroleum refinery:

A refiner has been offered 10,000 gallons of cylinder stock. The usual bargaining process will determine the final price. The would-be purchaser is interested in knowing how high a price he can pay and still make a profit.

COST ANALYSIS BUDGET

Department: Cracking Period Budgeted .... To . . ..

Supervisor . ...

Normal Capacity (100%) 100,000 Gallons Through-put

Department and/or Expense Account		Shut-down	60%	80%	100%	120%
Direct expenses:						
Direct labor	53-1					
Superintendence	53-2					
Supplies	53-3					
Repair materials	53-4					
Repair labor	53-5					
Depreciation	53-6					
Fuel—Natural gas	53-7					
Fuel—Cracking plant gas	53-8					
Royalties	53-11					
Miscellaneous	53-12					
Clean-out expense	53-16					
(Gas produced)	(53-20)					
(Fuel oil—produced and used)	(53-21)					
		$3,000	$7,000	$8,000	$8,500	$11,500
Allocated expenses:						
Fixed:						
Power and boilers	60					
Control laboratories	61					
Research laboratories	62					
Water plant	63					
Storage tanks	64					
Operational overhead	65					
General refinery overhead	66					
Variable:						
Power and boilers	60					
Control laboratories	61					
Research laboratories	62					
Water plant	63					
Storage tanks	64					
Operational overhead	65					
General refinery overhead	66					
		$ 500	$1,000	$1,500	$ 2,000	$ 3,000
Total costs		$3,500	$8,000	$9,500	$10,500	$14,500
Through-put:						
Total gallons		0	60,000	80,000	100,000	120,000
Differential gallons		0	60,000	20,000	20,000	20,000
Differential cost			$4,500	$1,500	$ 1,000	$ 4,000
Unit differential cost			$.075	$.075	$.05	$.20
Unit average cost			$.133	$.119	$.105	$.1208

FIGURE 198. Differential Costs Derived from Flexible Budget

The stock purchased would be processed into conventional bright stock and sold at that stage, since the blending unit for making finished motor oils is currently working at full capacity. The information available is as follows:

Cylinder stock is of such a quality and type that it will probably yield 90% bright stock, 5% petrolatum, 5% loss.

Current prices: bright stock $.50 per gal., petrolatum—no market.

Differential costs associated with processing 10,000 gals. of cylinder stock through several units (from analysis of budgets) :

Solvent dewaxing	$.02 per gal.
Solvent extraction	.02 per gal.
Filtering	.01 per gal.
Total	$.05 per gal.

Using this information, the refiner can analyze his position and determine his bargaining margin, as follows:

Margin Establishing Limit of Purchase Cost

Revenue-bright stock 9,000 gals. at $.50	$4,500.00
Differential costs, 10,000 gals. at $.05	500.00
Margin	$4,000.00

$4,000 ÷ 10,000 gal. = $.40 (point of no advantage)

The refiner is now ready to bargain for the purchase of the cylinder stock. He knows that a purchase price of forty cents a gallon represents his "break-even" point. To pay more would produce a loss, to pay less would result in a gain. He then makes his decision as to how much profit is required to justify the purchase. Here the concept of opportunity costs also enters into the final decision. If the available capacity could be more profitably used for another purpose, then perhaps the proposed purchase should not be consummated.

To Make or Buy a Component Part. Where it is a question of making an item or purchasing it ready-made, comparison must be made between the estimated cost to make the article and the purchase cost. There are three methods for making such comparisons.[4]

1. Preparation of complete operating data, in budget form or otherwise
2. Preparation of partial operating data
3. Differential costing

The first method is obvious, but laborious. It consists of preparing two complete budgets of the expenses of the *entire* business under conditions which will prevail if each of the proposed actions were adopted.

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[4] Illustration adapted from J. W. Culliton, *Make or Buy* (Cambridge: Harvard University Press, 1942), pp. 21 ff.

The second method is shorter in that it calls for a budget limited to the specific objective of the comparison. Thus, in a company facing a problem of reconstructing its printing plant destroyed by a flood or of purchasing its printing requirements, specific budgets covering each alternative could be prepared. Thus the difference between the first and second methods is merely one of the area to be covered. Under the differential cost method, the items of cost to be included are limited, as was stated earlier, to the variable costs affected by the decision. The illustration in Figure 199 shows the comparison of making or buying four different parts in which the fixed costs have been excluded. The following computations then show the most advantageous policy to pursue:

1. If all parts were made, the variable costs would be		$3,653.00
2. If all parts were purchased, the purchase cost would be		2,903.00
3. If parts #1 and #3 were made and parts #2 and #4 purchased, the costs would be:		
Part #1	$1,011.00	
" #3	521.00	
" #2	884.00	
" #4	389.00	2,805.00

Subject to factors not considered here, the last course of action seems indicated as the one to follow. One of these factors might be whether the plant is operating below or above standard capacity. This question is dealt with below.

Present Operation Below Capacity. The Ampere Electric Company produces a component part, No. XX29, in Department 19. Operating costs for this department are budgeted at $6,000 fixed costs per month, plus variable costs of $3 per unit produced. Standard capacity of the department is 10,000 units a month and the standard cost of the product (based upon production at standard capacity) is $3.60 per unit.

At a time when Department 19 was operating at 60% of standard capacity, the company's purchasing department called attention to the fact that it was able to buy a lot of 12,000 of Part XX29 for $2.75 each on contract from another manufacturer. A recommendation to close Department 19 for a limited time and buy the parts was made on grounds that it was possible to save $.85 per unit ($3.60 less $2.75). However, the accountant stated that the maximum saving would be $.25 per unit based upon the following analysis:

Cost of 12,000 units Part XX29 if purchased	$33,000.00
Comparative cost of manufacturing 12,000 units at $3 per unit	36,000.00
Total saving	$ 3,000.00
Saving per unit	$ .25

	Part No. 1 Steel Bushing	Part No. 2 Solid Steel Stud	Part No. 3 Hollow Steel Stud	Part No. 4 Knurled Steel Roll	Total
Cost to Make:					
Material	$ 414.00	$ 102.00	$150.00	$178.00	$ 844.00
Labor	199.00	700.00	150.00	160.00	1,209.00
Variable Overhead	398.00	810.00	221.00	171.00	1,600.00
Total Differential Cost	$1,011.00	$1,612.00	$521.00	$509.00	$3,653.00
Cost to Buy	1,110.00	884.00	520.00	389.00	2,903.00

FIGURE 199. To Make or Buy—Fixed Costs Excluded

He stated that he had not included the fixed cost of $6,000 per month in his calculation since this was composed of depreciation, property taxes, and salaries of supervisory employees who would not be laid off, and hence this amount could not be saved by shutting down the department temporarily. In addition, he suggested that some employees would find jobs elsewhere during the layoff and that costs of hiring and training enough new employees to replace them would probably exceed $3,000. With these facts available, it was decided to manufacture rather than to buy the parts.

Operation at 120% Practical Capacity. At another time Department 19 was operating at 120% of practical capacity, a figure which was the maximum output obtainable with a single shift. An additional 4,000 of Part No. XX29 was needed monthly and the company had to decide whether to put on a second shift or to buy the additional quantity needed. The item was available from another manufacturer at $3.50.

An additional shift would require hiring a foreman and additional indirect labor at $1,200 a month even though there is insufficient work to keep them fully occupied. Payment of shift premium and allowance for idle time due to low production might increase variable costs by 10%, or to $3.30 per unit. Comparison of cost to manufacture with cost to buy yielded the following figures:

Cost to manufacture	
Additional fixed costs monthly	$ 1,200.00
Variable costs, 4,000 units at $3.30	13,200.00
Additional cost if 4,000 units are manufactured	$14,400.00
Cost to buy—4,000 units at $3.50	14,000.00
Saving from purchasing	$ 400.00

After making certain that prompt delivery could be obtained and that standards for quality would be met, it was decided to buy the parts.

Acceptance or Rejection of Business at a Given Price. Sometimes, particularly in periods of rising prices, some thought must be given to the importance of *replacement costs* before reaching a decision accepting or rejecting a given offer.

The Telerad Wire Company manufactures insulated wire. The manufacturing process is simple and the cost of copper wire used is the principal item in the cost of the finished product. The company is offered an order at $.28 a pound which will require 10,000 pounds of a certain type of copper wire. The company has on hand 15,000 pounds of this wire for which it paid $.18 a pound. The standard cost of converting the uncovered wire into the finished product is $.05 a pound, including insulating materials. Superficially, the order might appear to be profitable. However, the company rejected the offer but offered to sell at \$.30 a pound. It did this on the grounds that (1) the current price of copper wire was \$.20 a pound and it would have to pay this much to replace the quantity withdrawn from inventory to fill the order, and (2) other customers would be willing to pay \$.30 since other wire manufacturers without inventories of material bought at the lower price would have to pay the current price for copper and they would advance their prices. Owing to the dominance of material cost, prices of finished wire ordinarily fluctuate closely with the price of copper.

The above is a fairly common situation. It helps to explain, if not to justify, why when inflationary pressures become sufficiently strong in the economy, manufacturers and distributors often withhold goods from the market. They do this because replacement would have to be made at still higher prices, thus wiping out their so-called profits.

Another point to be considered in accepting or rejecting an offer to buy is the inclusion of *all costs affected by a decision.* This is illustrated below.

The Titan Paint Company accepted an order from a chain store organization for a large quantity of low-price paint with shipments to be made from time to time at the request of the buyer. It was expected that this order would substantially increase profits, for it would increase volume in the factory. In addition, this added volume would entail practically no selling expense since the president obtained the order directly from a vice-president of the chain. However, at the end of a year, profits of the Titan Company were lower than for the previous year. A management consultant was engaged to determine the cause of the unsatisfactory profit and to recommend methods for improvement. In reporting, the consultant pointed out that while manufacturing costs had been reduced by the increased volume, shipping and transportation costs had risen markedly. An analysis of these costs showed that the chain store had called for a great many small shipments which caused the increase in shipping expenses. Moreover, these shipments had been made to individual stores in thirty-two states. LCL (less than carload lots) freight rates and the long distances involved had been another factor in increasing costs. The consultant recommended discontinuing further sales to the chain on the ground that such orders were unprofitable. However, the president of the Titan Company renewed the arrangement with the chain store after obtaining an agreement that shipments would be made in equal monthly installments to the chain store's central warehouse in a nearby city. While a mistake had been made at first in failing to recognize all costs associated with the order, he felt sure that all costs were now known and that the chain store's business would be profitable.

Selection of Equipment. In making studies of comparative costs, interest on the investment must often be considered, particularly when it is a question of deciding between a manually performed operation and one performed automatically with special purpose machinery. This is illustrated below.

The Baker Company has decided to open a branch sales office in Denver. Clerical work connected with filling orders and billing customers will be done in this office and the company is studying various possible methods for accomplishing this work in order to find the most economical one. The illustration below is based on a comparison of two proposed methods for one set of operations.

Method A. This method uses three clerks and simple manual equipment costing $2,000. It is expected that the equipment will last 10 years and requires $50 a year for maintenance and repairs. Clerks of the required grade can be hired for $3,000 each a year. Any increase over present volume of work will require an additional clerk.

Method B. This method would use several modern office machines costing $15,000. These machines are also expected to have a useful life of 10 years and to require $100 a year for maintenance. Only two clerks will be needed, but these must be trained machine operators paid $3,500 each a year. The two clerks can handle double the present volume of work and the only added expense will be for additional paper forms and similar supplies.

Since Method B would require an outlay of $15,000 for equipment in comparison with only $2,000 for Method A, it was necessary to include this difference in the capital required in the cost comparison. In order to place the cost of capital on an annual basis like the other costs, interest on investment was included with the estimated costs. For this purpose, the rate of interest employed was 8% because the company could earn this rate in other uses which could be made of the capital within the company. Annual interest was computed on the *average* amount invested in the equipment during its expected life of 10 years. It would not be accurate to use the initial cost of the equipment for this purpose because the amount invested in the asset is reduced by the annual credit to the reserve for depreciation each year. More elaborate methods for computing annual interest cost are sometimes used, particularly when the expected life of the asset is long. However, it should be remembered that important figures which enter into the computation are estimates (e.g., the expected life of the equipment) or are rather arbitrarily determined (e.g., the rate of interest employed). As a result, the annual cost calculations cannot be exact. Hence there is often nothing to be gained through the application of more laborious methods of computation.

When the figures were assembled, the following comparison resulted:

Method A: Annual Costs

Equipment—initial investment $2,000		
Depreciation—10%	$ 200.00	
Interest at 8% on average capital ($1,000 × .08)	80.00	
Maintenance	50.00	$ 330.00
Salaries—3 clerks at $3,000		9,000.00
Supplies		100.00
Total annual cost		$9,430.00

Method B: Annual Costs

Equipment—initial investment $15,000		
Depreciation—10%	$1,500.00	
Interest at 8% on average capital ($7,500 × .08)	600.00	
Maintenance	100.00	$2,200.00
Salaries—2 clerks at $3,500		7,000.00
Supplies		200.00
Total annual cost		$9,400.00

Since there is little difference in expected annual costs, the decision should be made upon other factors not included in the cost comparison. Among such factors considered in this decision were:

1. Quality and availability of service for equipment
2. Adaptability to changes in operations performed
3. Effect on cost if volume increases or decreases
4. Availability of trained employees or cost of training
5. Likelihood that better equipment will be available in the near future
6. Availability of capital for purchase of equipment

QUESTIONS

1. "The usual profit and loss statement shows only what costs and revenues were at one specific rate of activity." Explain why the cost accountant develops techniques for relating profit, volume, and costs over ranges of levels of activity.
2. What is meant by market sectionalization and what elements restrict such sectionalization?
3. What basic classes of managerial decisions can best be approached from a differential costing basis?
4. "Costs are not inherently fixed but acquire this characteristic as a result of policies established by management and decisions made at budget conferences." Do you agree? Explain by illustration.
5. Illustrate conditions under which direct labor may be viewed as a fixed cost.

6. Differentiate between analysis by use of average costs and analysis by reference to differential costs.
7. Explain what is meant by making profit by:
   a) Continuing to sell one item in the line at a loss
   b) Operating the entire plant at a loss
8. What factors should be considered and how should calculations be made in deciding on whether or not to drop a particular sales territory?
9. Discuss the extent to which tax considerations may outweigh other factors in consideration of the possibility of mechanizing a particular operation.
10. Explain the usefulness of cost records in the accounts in making comparative cost studies.
11. The Free-Air Ventilating Equipment Company is desirous of stabilizing production throughout the year. The following proposals have been made:
    a) Produce at an even pace throughout the year, storing off-season production on the premises
    b) Produce at an even pace but offer dealers a special discount for off-season purchases
    c) Extend special terms to dealers, but maintain prices to move goods regularly throughout the year

    Discuss the relative merits and shortcomings of the above proposals.

PROBLEMS

PROBLEMS

CHAPTER 1

1–1. Prepare statements showing cost to produce and profit on sales of a small creamery, the books of which show as follows:

January 1: butter on hand, 1,000 lbs., valued at $350; sweet cream purchases, 400,000 lbs., purchased on basis of butter-fat test at $.30 per pound butter fat; coloring matter $250; miscellaneous factory supplies $175; freight and commissions on purchases $325; labor cost for year $9,500; insurance and taxes $165.49; factory light and power $975; depreciation on plant $685.

Inventory December 31: 485 lbs. of butter valued at cost; selling and administrative expense amounted to $5,884.45.

Sales were $125,565; allowances for losses on shipments $143.75.

Assume that 1¼ lbs. cream tests 1 lb. butter fat, and 1 lb. of fat produces 1⅙ lbs. of butter.

Note: Unit costs to be rounded off in the fourth decimal place.

1–2. The following is a statement of the profit and loss of the Lacdun Company for the year ended August 31, 1952:

Sales		$600,000.00
Cost of Sales		
Materials	$195,000.00	
Direct Labor	130,000.00	
Factory Expense	65,000.00	390,000.00
Gross Profit		$210,000.00
Selling Expense	$ 90,000.00	
Administrative and General Expense	40,000.00	130,000.00
Net Profit		$ 80,000.00

For the year ending August 31, 1953, it is expected that the sales will increase 33⅓% in volume, while selling and general expenses, as well as the production costs, are estimated to advance as follows:

The cost of materials and direct wages are expected to go up 20%, but there will be a reduction of 10% in the material content of the finished product.

Factory expense is expected to be relatively 15% higher.

Selling expense is expected to increase 20% and general expense 25%.

By what percentage must the selling price be increased in order that the net profit for the year ending August 31, 1953, shall exceed that of the previous year by 25%?

(Adapted from an American Institute of Accountants examination)

1–3. The operations of K. Inc. for the fiscal year ended June 30, 1952, are expressed in the following table of percentages:

		Per Cent
Sales		100.00
Cost of Sales		66.67
Gross Profit		33.33
Expenses		
Selling and Delivery	10.00	
Administration and General	7.50	17.50
Net Profit		15.83

There was no inventory at the beginning of the fiscal year and during that year the company, operating at full capacity, produced 10,000 units, of which 8,000 were sold. The materials, labor, and overhead were, respectively, 35%, 45%, and 20% of the cost of production.

The current year's costs are expected to show increases as follows: materials 15%; labor 10%; overhead 20%. On the other hand, it is expected that, because of more efficient methods, the production will be increased 10%, and you are to assume that this is accomplished without additional increases in the cost of production.

Negotiations are pending with S & R who are prepared to purchase K. Inc.'s entire output for the current year, together with the stock on hand at the beginning of the current year, if the parties can agree on a price. In that event the amount of the selling and delivery expense would be reduced 75%, and there would be no change in the amount of the administration and general expense.

Accepting the indicated changes in costs and production, what percentage of increase or decrease in the 1952 selling price per unit would enable K. Inc. to realize, under the contemplated arrangement, a net profit of 20% on the sales?

(Adapted from an American Institute of Accountants examination)

CHAPTER 2

2–1. The Cornell Manufacturing Company operates a general accounting system, and the trial balance after closing the books on December 31, 19—, appeared as follows:

Cash	$ 7,000.00
Accounts Receivable	20,000.00
Raw Materials and Supplies	8,000.00
Work in Process	3,500.00

Finished Goods	$11,500.00	
Machinery and Equipment	25,000.00	
Prepaid Insurance	300.00	
Accounts Payable		$ 9,000.00
Labor Accrued		225.00
Taxes Accrued		150.35
Capital Stock		50,000.00
Surplus		15,924.65
	$75,300.00	$75,300.00

1. During the month of January the voucher register showed the following charges:

Purchases—Raw Materials and Supplies	$ 4,125.25
Labor	5,510.25
Manufacturing Overhead	2,117.20
Selling Expense	3,772.10
Administrative Expense	2,895.25
	$18,420.05

2. The summary of the sales journal amounted to $24,702.35.

3. The cash receipts journal showed that customers had paid $19,201.10 less 2%.

4. The cash payments journal showed for the month payments to creditors amounting to $12,415.07 less 2%, and an amount of $5,510.25 for labor was paid.

5. Adjustments were as follows:

Raw Materials and Supplies	$5,385.65
Work in Process	7,596.98
Finished Goods	7,527.56
Depreciation	225.10
Prepaid Insurance	208.85
Taxes Accrued (additional)	102.15
Rent Accrued	315.00
Labor Accrued	550.30

Required:

a) Current, adjusting, and closing entries.

b) Set up work sheet, with appropriate columns for trial balance, current period transactions and adjustments, profit and loss, and balance sheet.

c) Statement of production cost.

d) Statement of profit and loss.

e) Balance sheet.

2–2. The following information was derived from the records of the Allen Manufacturing Corporation. Prepare a statement of production cost, statement of cost of sales, and a profit and loss statement for January, 19—.

Raw Materials Purchased	$ 75,000.00
Direct Labor	80,000.00
Indirect Labor	10,000.00
Power—Factory	8,000.00
Heat and Light—Factory	6,000.00
Superintendence	10,000.00
Insurance—Factory	1,000.00
Payroll Taxes—Factory	4,500.00
Depreciation—Plant and Equipment	8,000.00
Tools—Factory	1,500.00
Miscellaneous Factory Overhead	1,000.00
Sales	450,000.00
Selling and Administrative Expenses	150,000.00

Inventories	January 1	January 31
Raw Materials	$125,000.00	$ 85,000.00
Work in Process	160,000.00	150,000.00
Finished Goods	140,000.00	160,000.00

2–3. From the following information submit a statement of production cost, a statement of cost of sales, and a statement of profit and loss for the Ford Manufacturing Corporation.

Sales	$400,000.00
Sales Returns and Allowances	2,000.00
Purchases—Raw Materials	75,000.00
Direct Labor	65,000.00
Factory Supplies	8,000.00
Manufacturing Overhead	
Indirect Labor	10,000.00
Rent—Factory	4,000.00
Heat and Light	2,000.00
Power	2,500.00
Compensation Insurance	2,400.00
Fire and Liability Insurance	800.00
Payroll Taxes	3,750.00
Depreciation—Factory Building	4,500.00
Depreciation—Machinery and Equipment	7,500.00
Miscellaneous Factory Expense	400.00
Taxes—Factory Building	600.00
Selling Expense	75,000.00
Administrative Expense	28,000.00
Inventories, December 1, 19—	
Raw Materials	125,000.00
Work in Process	35,000.00
Finished Goods	100,000.00
Factory Supplies	4,000.00
Inventories, December 31, 19—	
Raw Materials	100,000.00
Work in Process	50,000.00
Finished Goods	75,000.00
Factory Supplies	6,000.00

2–4. The following was derived from the books of the Kiernan Manufacturing Corporation at December 31, 19—:

Raw Materials Purchases	$158,630.00
Factory Supervisory Salaries	14,202.00
Freight-In on Raw Materials	15,170.00
Direct Labor	236,842.00
Raw Materials Purchase Returns	7,800.00
Indirect Factory Wages	79,044.00
Manufacturing Supplies Used	11,960.00
Taxes—Factory Building	3,280.00
Insurance—Factory	3,744.00
Power—Factory	29,976.00
Light—Factory	4,930.00
Fuel—Factory	22,840.00
Wages—Power Plant	36,250.00
Depreciation—Building	7,720.00
Depreciation—Machinery	12,440.00
Factory Building Repairs	8,440.00
Machinery Repairs	9,690.00
Payroll Taxes—Factory	11,322.00
Raw Materials Inventory, January 1, 19—	80,720.00
Raw Materials Inventory, December 31, 19—	76,224.00
Work in Process Inventory, January 1, 19—	68,204.00
Work in Process Inventory, December 31, 19—	92,010.00
Finished Goods Inventory, January 1, 19—	97,890.00
Finished Goods Inventory, December 31, 19—	130,740.00

Required: Statement of cost of goods sold for year ended December 31, 19—.

CHAPTER 3

3–1. The Cornell Manufacturing Company operates a cost system and at the close of the period, December 31, 19—, their ledger showed the following balances:

Cash	$ 7,000.00
Retained Earnings	15,924.65
Payroll Accrued	225.00
Taxes Accrued	150.35
Accounts Receivable	20,000.00
Accounts Payable	9,000.00
Capital Stock	50,000.00
Stores	8,000.00
Work in Process	3,500.00
Finished Goods	11,500.00
Machinery and Equipment	25,000.00
Prepaid Insurance	300.00

During the month of January transactions were as follows:

1. Stores purchased, $4,125.25.
2. Stores used:

Direct Materials	$5,625.50
Indirect Materials	1,114.10
	$6,739.60

3. Time tickets were analyzed and found to be as follows:

Direct Labor	$4,110.25
Indirect Labor	1,725.30
	$5,835.55

The payroll disbursed amounted to $5,510.25.

4. The total of manufacturing overhead charged to production equaled the amount of actual manufacturing overhead during the month.

5. Voucher register charges were as follows:

Manufacturing Overhead	$2,117.20
Selling Expense	3,772.10
Administrative Expense	2,895.25
	$8,784.55

6. The fixed charges charged to manufacturing overhead for the month were:

Depreciation	$225.10
Insurance	91.15
Taxes	102.15
Rent	315.00
	$733.40

7. The production for the month was valued at $11,328.77.
8. The cost of sales during the month was $15,301.21.
9. The sales were $24,702.35.
10. Payments from customers amounted to $19,201.10 less 2%.
11. Creditors accounts in the amount of $12,415.07 less 2% were paid.

Required:

a) Journal entries, work sheet. Allow three lines each for cash, work in process, vouchers payable, and four lines for manufacturing overhead.
b) Statement of production cost.
c) Statement of profit and loss.

3–2. The following information was taken from the books and records of the Gerrard Manufacturing Company.

Opening balances, January 1, 19—	
Cash	$ 3,000.00
Accounts Receivable	2,000.00
Raw Materials	6,000.00
Finished Goods	7,000.00
Plant and Equipment	75,000.00
Vouchers Payable	3,000.00
Bonds Payable	30,000.00
Capital Stock	50,000.00
Retained Earnings	10,000.00

Transactions during the month were as follows:

1.	Raw materials purchased	$ 50,000.00
2.	Raw materials requisitioned	45,000.00
3.	Direct labor paid	30,000.00
4.	Manufacturing overhead actual	10,000.00
5.	Manufacturing overhead applied	10,000.00
6.	Operating expenses incurred and paid:	
	Salesmen's Salaries	2,500.00
	Advertising	1,000.00
	Legal Expense	500.00
	Office Expense	3,000.00
7.	Interest on Bonds Payable paid	150.00
8.	Completed production	80,000.00
9.	Sales	125,000.00
10.	Cost of sales	75,000.00
11.	Creditors paid:	
	Cash	43,000.00
	Cash Discount on Purchases	2,000.00
12.	Customers paid as follows:	
	Cash	105,000.00
	Cash Discount on Sales	3,000.00

Required:

a) Journal entries under cost and noncost systems.
b) Trial balance under cost and noncost systems.
c) Statement of production cost.
d) Profit and loss statement.

3–3. The Hoopingarner Manufacturing Company's ledger shows the following cost accounts as of January 31, 19—:

STORES

1/1	Inventory		$ 5,000.00	1/31	Requisitions		$19,225.00
1/31	Purchases	VR	22,000.00	1/31	Vouchers Payable	VR	780.00
1/31	Returns	J	450.00				

PARTS DEPARTMENT—MATERIAL IN PROCESS

1/1	Inventory		$ 2,250.00	1/31	Returns	J	$ 125.00
1/31	Stores	J	6,375.00	1/31	Finished Parts	J	7,125.00

PARTS DEPARTMENT—DIRECT LABOR IN PROCESS

1/1	Inventory		$ 1,350.00	1/31	Finished Parts	J	$ 3,440.00
1/31	Time Tickets	J	2,920.00				

PARTS DEPARTMENT—MANUFACTURING OVERHEAD IN PROCESS

1/1	Inventory		$ 825.00	1/31	Finished Parts	J	$ 1,550.00
1/31	Applied		1,930.00				

ASSEMBLY DEPARTMENT—MATERIAL IN PROCESS

1/1	Inventory		$ 2,250.00	1/31	Returns	J	$ 325.00
1/31	Stores	J	10,850.00	1/31	Finished Goods	J	15,775.00
1/31	Finished Parts	J	5,350.00				

ASSEMBLY DEPARTMENT—DIRECT LABOR IN PROCESS

1/1	Inventory		$ 1,350.00	1/31	Finished Goods	J	$ 8,250.00
1/31	Time Tickets	J	9,600.00				

ASSEMBLY DEPARTMENT—MANUFACTURING OVERHEAD IN PROCESS

1/1	Inventory		$ 825.00	1/31	Finished Goods	J	$ 7,360.00
1/31	Applied	J	7,720.00				

FINISHED PARTS

1/1	Inventory		$11,220.00	1/31	Requisitions	J	$ 5,350.00
1/31	Production	J	12,115.00	1/31	Cost of Sales	J	6,725.00

FINISHED GOODS

1/1	Inventory		$10,150.00	1/31	Cost of Sales		$32,350.00
1/31	Production		31,385.00				

PAYROLL ACCRUED

1/31	Payroll	VR	$13,120.00	1/31	Summary	J	$14,770.00

MANUFACTURING OVERHEAD

1/31	Indirect Labor	J	$ 2,250.00	1/31	Applied	J	$ 9,650.00
1/31	Indirect Material	J	2,000.00				
1/31	Sundries	VR	3,750.00				
1/31	Fixed Charges	J	1,650.00				

COST OF SALES

1/31	Finished Parts	J	$ 6,725.00				
1/31	Finished Goods	J	32,350.00				

Required:

a) Reconstruct the journal entries (except for opening balances) giving rise to the above ledger accounts.

b) Summary cost of sales schedule with supporting cost of production schedule showing costs for finished parts and finished goods.

c) Cost of production schedule showing, separately, costs to produce finished parts and finished goods by elements of cost. *Note:* Set up columnar headings for Totals, Material, Labor, and Overhead.

3–4. The Jonathan Manufacturing Company manufactures parts for use in finished goods. Some of the parts are sold by the company as replacements. The following balances were taken from the cost accounts on December 31, 19—:

Stores	$ 5,000.00
Parts Department—Material in Process	5,750.00
Parts Department—Direct Labor in Process	4,500.00
Parts Department—Manufacturing Overhead in Process	1,500.00
Assembly Department—Material in Process	3,350.00
Assembly Department—Direct Labor in Process	2,080.00
Assembly Department—Manufacturing Overhead in Process	1,560.00
Finished Parts	5,625.00
Finished Goods	17,820.00

The following transactions took place during January:

1. Stores purchased		$24,000.00
2. Stores issued		25,125.00
Parts Department	$11,375.00	
Assembly Department	10,750.00	
Indirect Materials	3,000.00	
3. Factory payroll		22,775.00
4. Labor distribution		22,775.00
Parts Department	9,675.00	
Assembly Department	9,600.00	
Indirect Labor	3,500.00	
5. Sundry actual manufacturing overhead (credit Miscellaneous Accounts)		4,200.00
6. Applied manufacturing overhead		10,425.00
Parts Department	3,225.00	
Assembly Department	7,200.00	
7. 4,200 parts finished during month		31,500.00
Material	13,580.00	
Labor	13,440.00	
Manufacturing Overhead	4,480.00	
8. 1,200 parts used in production of finished goods		9,000.00
Material	3,880.00	
Labor	3,840.00	
Manufacturing Overhead	1,280.00	
9. 1,300 finished units completed during month		24,180.00
Material	15,080.00	
Labor	5,200.00	
Overhead	3,900.00	
10. Cost of sales for month		44,850.00
1,500 Finished Parts	11,250.00	
1,800 Units Finished Goods	33,600.00	

The following is an analysis of cost elements of the inventories of finished parts and finished goods at December 31, 19—:

	Units	Material	Labor	Overhead	Total
Finished Parts	750	$ 2,425	$2,400	$ 800	$ 5,625
Finished Goods	950	11,170	3,800	2,850	17,820

Required:

a) Construct the ledger accounts for the above transactions.
b) Summary cost of sales schedule with supporting cost of production schedule, showing costs for finished parts and finished goods. *Note:* Set up columnar headings for Totals, Finished Parts, Finished Goods.
c) Summary cost of sales schedule with supporting cost of production schedule, showing separately costs to produce finished parts and finished goods by elements of cost. *Note:* Set up columnar headings for Totals, Material, Labor, and Overhead. Disregard underabsorbed overhead in computing unit costs.

CHAPTER 4

4–1. The Bell Manufacturing Corporation operates a factory which maintains separate records of production and the main office maintains the general books of account which control the factory office records.

a) Record the following information in the appropriate journals.

1. Direct materials received in the amount of		$35,000.00
2. Indirect materials received in the amount of		5,000.00
3. Freight on direct materials		249.00
4. Direct materials returned to vendor		78.00
5. Payroll amounted to		20,000.00
Direct Labor	$14,000.00	
Indirect Labor	2,000.00	
Superintendence	4,000.00	
6. Payroll taxes on above payroll		2,010.00
Withholding Tax	1,500.00	
F.I.C.A.	300.00	
Disability Insurance	210.00	
7. The manufacturing overhead for the month amounted to		6,425.00
Rent of factory building	4,000.00	
Heat, light, and power	1,000.00	
Insurance	175.00	
Depreciation	1,250.00	
8. Materials used		22,000.00
Direct Materials	18,000.00	
Indirect Materials	4,000.00	
9. Manufacturing Overhead was applied to production at 90% of direct labor cost.		
10. The payroll, withholding tax, and F.I.C.A. taxes were paid.		
11. The federal and state unemployment compensation taxes were paid. (Assume maximum 3% rate.)		
12. The goods finished during the month amounted to		29,950.00
Materials	10,000.00	
Labor	10,500.00	
Manufacturing Overhead	9,450.00	
13. Goods costing $25,000.00 were sold for		43,000.00

b) After journalizing the above transactions, prepare the closing entries.
c) Prepare a cost of sales schedule.

4–2. The Cunningham Manufacturing Corporation operates a factory ledger which on January 1, 19— showed the following balances:

Stores	$12,840.00
Work in Process	20,135.00
Finished Goods	19,040.00

During the month the transactions appeared as follows:

Stores purchased		$110,450.00
Stores returned to vendors		5,690.00
Payroll accrued (earned and paid)		66,091.00
Direct Labor	$60,148.00	
Indirect Labor	5,943.00	
Stores issued		97,070.00
Direct Materials	95,432.00	
Indirect Materials	1,638.00	
Manufacturing overhead incurred other than indirect labor and indirect materials		41,920.00
Applied Manufacturing overhead based on predetermined rates		47,935.00
Completed production		195,170.00
Cost of sales		198,320.00
Sales returns at cost		4,650.00

Required: Factory journal entries.

4–3. Record the following transactions in a voucher register using columnar titles as suggested in the text.

November 1. Purchased machine repair parts from Standard Machine Co. $195. These parts are to be kept in reserve for future use.

Purchased raw materials from Chase Brass Co. in the amount of $5,400.

Paid freight on above shipment $84 to Seaboard Freight Lines (check 1404).

4. Vouchered and paid rent $650 to Wantaugh Holding Co. (check 1405). Rent distributed as follows: $400 to factory, $150 to selling, and $100 to administration.

Purchased a new power stamping machine from Standard Machine Co. for $2,100.

Paid freight on above machine $200 to Machine Delivery Service (check 1406).

6. Paid insurance premium on factory equipment $320 to Bartlett Agency. This covers insurance for one year (check 1407).

Purchased raw materials from Reynolds Metal Co., $4,100.

10. Purchased oil and other supplies for factory use from Burns & Co. $310.

Prepared voucher and paid $204 to Peter Allen, salesman, for traveling expenses (check 1408).

15. Received credit from Chase Brass Co. in the amount of $110.

Paid Chase Brass Co. less 1% cash discount (check 1409).

Vouchered and paid payroll $4,000 after withholding $600 in payroll taxes (check 1410).

Distribution of payroll: factory $3,050, sales salaries $900, office salaries $650.

November 18. Received and paid power and light bill $190 (check 1411 to Niagara Electric Co.).
Distribution: factory $140, selling $30, office $20.
21. Paid $2,000 instalment on loan from the Patient Finance Co. (check 1412).
Paid Reynolds Metal Co. (check 1413).
23. Received telephone bill $85 from New York Telephone Co.
Distribution: factory $20, selling $55, office $10.
30. Vouchered and paid payroll $3,800 after withholding $510 in payroll taxes (check 1414).
Distribution: factory $2,900, selling $820, office $590.

4–4. The following transactions relate to the Superior Products Co. for the month of April, 19—.

1.	Stores purchased	$18,000
2.	Fuel purchased	1,200
3.	Bill received from Niagara Power Co.	800
4.	Invoice from B. T. Brenner, insurance agent for workmen's compensation insurance	786
5.	Voucher prepared for factory payroll	15,500
6.	Depreciation on machinery and equipment	1,900
7.	Insurance on machinery and equipment (expired)	395
8.	Power consumed (estimated)	760
9.	Compensation insurance estimated	290
10.	Payroll taxes (factory payroll), estimated	480
11.	Stores returned to vendor	500
12.	Direct materials issued from stores	14,000
13.	Indirect materials and supplies issued from stores	1,200
14.	The labor distribution shows direct labor	11,500
15.	Indirect labor shown on labor distribution	4,000
16.	Manufacturing overhead applied to production	7,650

Required: Set up a factory journal as illustrated in the text and enter only those transactions normally recorded in that journal. For transactions affecting other journals, indicate whether they are to be recorded in voucher register or general journal.

4–5. As of December 31, 1953, the X. B. Manufacturing Company, with outstanding capital stock of $30,000, had the following assets and liabilities:

Cash	$ 5,000.00
Accounts Receivable	10,000.00
Raw Materials Inventory	4,000.00
Work in Process Inventory	2,000.00
Finished Goods Inventory	6,000.00
Prepaid Expenses	500.00
Fixed Assets (net)	30,000.00
Current Liabilities	17,500.00

During the year 1954, the surplus account increased 50% as a result of the year's business. No dividends were paid during the year. Balances of accounts receivable, prepaid expenses, current liabilities, and capital stock were the same December 31, 1954, as they had been on December 31, 1953. Inventories were reduced by exactly 50% except for the finished goods inventory which was reduced by one third. Fixed assets (net) were reduced by depreciation of $4,000, charged three fourths to manufacturing overhead and one fourth to general expense. Sales were made at 50% above their cost of $40,000. Direct labor cost was $9,000 and manufacturing overhead was applied at a rate of 100% of labor cost, leaving $2,000 unapplied which was included in the cost of goods sold. Total general expense and selling expense amounted to 15% and 10%, respectively, of the gross sales.

You are to prepare a balance sheet as of December 31, 1954, and a statement of profit and loss for the year 1954 including therein or in a separate schedule the details of cost of goods manufactured and sold. Support the formal statements with work sheet or "skeleton" ledger accounts.

(Adapted from an American Institute of Accountants examination)

CHAPTER 5

5–1. The Rego Manufacturing Company wishes to use a decimal code for its chart of accounts. The controller's division has been assigned number 85.0 for expenses. This division is divided into four departments: General Accounting, Budgets, Internal Auditing, and Cost Accounting and they, in turn, are subdivided according to their normal functions.

You are requested to compose a code of the controller's division expenses which might be used in a manufacturing company.

5–2. The Premier Boiler Company has the following manufacturing departments:

1. Cutting
2. Welding seams
3. Inserting tops and bottoms
4. Tapping
5. Stenciling
6. Inspection

Devise a numerical block code and chart of accounts showing the factory expenses which might normally be charged to each department. Show at least twelve accounts for each department.

5–3. The following expense account titles appear in the Manufacturing Overhead subsidiary ledger of the Pines Manufacturing Corporation.

Fuel
Compensation Insurance
Water
Engineers
Timekeepers
Storeskeepers

Power
Light
Heat
Factory Supplies
Maintenance Materials—Factory Building
Maintenance Materials—Machinery
Foremen
Plant Superintendent
Building Maintenance Labor
Machine Royalty Fees
Depreciation—Machinery
Depreciation—Building
Insurance—Machinery
Insurance—Building
Taxes—Building
Payroll Taxes

Required:

a) Classify these items as either fixed or variable expense. (Where an expense appears to be semivariable classify as either fixed or variable depending on which classification it most nearly resembles.)

b) Explain the significance of the classification called for.

5–4. The following table represents a simple manufacturing overhead distribution sheet.

Expense	Total	Producing Dept. 1	Producing Dept. 2	Producing Dept. 3	Service Dept. A	Service Dept. B
Heat	$ 900.00	$ 200.00	$ 350.00	$ 200.00	$ 100.00	$ 50.00
Light	600.00	100.00	175.00	150.00	100.00	75.00
Power	750.00	250.00	350.00	150.00		
Fuel	400.00	400.00				
Water	125.00	125.00				
Superintendent	2,000.00					2,000.00
Foremen	3,500.00	1,000.00	750.00	750.00	500.00	500.00
Other Indirect Labor	2,500.00	500.00	500.00	400.00	700.00	400.00
Depreciation—Machinery	480.00	100.00	280.00	50.00	25.00	25.00
Depreciation—Building	600.00	100.00	200.00	175.00	75.00	50.00
Taxes—Building	900.00	150.00	300.00	263.00	112.00	75.00
Insurance—Machinery	240.00	50.00	140.00	25.00	13.00	12.00
Insurance—Building	450.00	75.00	150.00	132.00	56.00	37.00
Compensation Insurance	700.00	150.00	200.00	150.00	100.00	100.00
Payroll Taxes	1,050.00	225.00	300.00	225.00	150.00	150.00
Factory Supplies	1,300.00	400.00	350.00	450.00	60.00	40.00
	$16,495.00	$3,825.00	$4,045.00	$3,120.00	$1,991.00	$3,514.00

a) Refer to the table above and differentiate between a natural and functional classification of manufacturing overhead.

b) As a cost accountant indicate different purposes served by functional classifications and natural classifications of manufacturing overhead.

CHAPTER 6

6–1. The ABC Stone and Lime Corporation engages in the quarrying of limestone and produces the following types of finished limestone products: Bulk Lime, Hydrated Lime, Ground Limestone, Fluxing Limestone, Furnace Limestone, and Agricultural Limestone. The direct departmental costs for the year are tabulated on the following page.

	Quarry	Bulk Lime	Hydrated Lime	Ground Limestone	Fluxing Limestone	Furnace Limestone	Agricultural Limestone
Supplies	$ 83,000.00	$ 4,000.00	$ 6,500.00	$ 4,000.00	$ 500.00	$ 100.00	$ 650.00
Labor	100,000.00	80,000.00	30,000.00	60,000.00	20,000.00	5,000.00	5,000.00
Maintenance	2,000.00	5,000.00	500.00	5,000.00	1,000.00	500.00	4,000.00
Truck and Shovel Expenses	31,000.00	-	-	-	-	-	-
Social Security Taxes	2,700.00	2,400.00	900.00	1,800.00	600.00	150.00	150.00
Pumping Expense	19,000.00	-	-	-	-	-	-
Depreciation	8,000.00	5,000.00	100.00	800.00	300.00	200.00	1,200.00
Insurance	7,000.00	1,600.00	600.00	1,900.00	300.00	250.00	3,000.00
Taxes	6,300.00	2,000.00	1,400.00	3,500.00	300.00	800.00	3,000.00
Coal	-	65,000.00	-	-	-	-	-
	$259,000.00	$165,000.00	$40,000.00	$77,000.00	$23,000.00	$7,000.00	$17,000.00

Indirect expenses of operations are as follows:

Electric power	$45,000.00
General Superintendence Salaries	$16,000.00
General Maintenance	9,000.00
General Production Expense	20,000.00
Social Security Taxes	480.00
Insurance	4,520.00
Depreciation	5,000.00
Taxes	5,000.00
	$60,000.00

Indirect expenses, other than electric power, are prorated among the several departments on a labor dollar basis. Electric flow meters indicated that the various departments had utilized electric power as follows:

Quarry	270,000 kwh.
Bulk Lime	180,000 kwh.
Hydrated Lime	180,000 kwh.
Ground Limestone	90,000 kwh.
Fluxing Limestone	90,000 kwh.
Furnace Limestone	45,000 kwh.
Agricultural Limestone	45,000 kwh.
	900,000 kwh.

During the year the quarrying operations produced 500,000 tons of raw limestone. Depletion, based on cost, is computed on the basis of one and one-half cents per ton. In the production of bulk lime, a rate of product realization of 50% is experienced by the company. Hydrated lime is produced from bulk lime without any further product loss. There is no processing loss experienced in the production of the other types of limestone. There were no inventories of stone at either the beginning or end of the year. The quantities of product sold during the year were as follows:

Bulk Lime	140,000 tons
Hydrated Lime	35,000 tons
Ground Limestone	75,000 tons
Fluxing Limestone	50,000 tons
Furnace Limestone	10,000 tons
Agricultural Limestone	15,000 tons
	325,000 tons

Required: From the information given, compute the cost of the various products in total and show the cost per ton.

6–2. The records of Rowe Corporation for the six months ended June 30, 19—, show the following facts: raw materials inventory, January 1, 19—, $3,600; purchases $26,615; direct labor $30,000; manufacturing overhead applied (120% of direct labor) $36,000; underapplied manufacturing overhead $300; finished goods inventory, January 1, 19—, $6,200; selling expense $30,300; administrative and general expenses $43,200.

A review of the records discloses the following additional information bearing on the above facts:

1. Purchases consist of the following:

	Units	Unit Price	Amount
January	1,100	$4.85	$ 5,335
February	900	5.00	4,500
March	500	4.90	2,450
April	700	5.00	3,500
May	900	5.10	4,590
June	1,200	5.20	6,240
			$26,615

2. Purchases during January, as above, do not reflect a supplier's credit memo in the amount of $450.

3. Data with respect to quantities are submitted as follows:

	Units	
	Jan. 1	June 30
Raw Materials	700	
Work in Process (80% complete)	None	500
Finished Goods	300	800
Sales, 4,100 units		

Raw materials are issued at outset of the manufacturing process and during the six-month period it may be assumed that no returns, spoilage, or waste occurred. Each unit of finished goods contains one unit of raw material.

4. A 5% increase in all direct labor payrolls, retroactive to January 1, 19—, was approved by a federal board on July 15 of this year. Pending such approval, the 5% wage increase had not been accrued in the books although an equivalent amount of cash had been set aside in escrow for the employees by the company.

Required:

a) Prepare a statement of cost of goods sold. For purposes of this statement, inventories are to be stated at cost as follows: materials, according to the first-in first-out method of accounting; direct labor, at an average rate determined by correlating total direct labor cost with effective production during the period; and manufacturing overhead, at an applied rate of 120% of the direct labor rate.

b) Submit cost control accounts showing both quantities and dollar amounts.

(*Adapted from an American Institute of Accountants examination*)

6-3. The Acme Manufacturing Corporation uses a process cost system; manufacturing costs, other than direct materials and direct labor, are applied to the product in an amount equal to 50% of the direct labor cost, and, per contra, are credited to an account, "applied manufacturing overhead." The books were closed as of December 31, 1952, when the inventory of goods in process in Process A consisted of 1,000 units of product as follows:

Direct material content (100% complete)	$5,000.00
Direct labor content (average 50% complete)	2,000.00
Applied Manufacturing overhead (at 50% of direct labor costs)	1,000.00
Total	$8,000.00

In January, 1953, 10,000 additional units of product were started; material requirements in full were issued at a cost of $51,000; direct labor amounted to $39,900; manufacturing overhead was applied at 50% of the direct labor cost; 9,000 units were completed and transferred to the next process; 2,000 units remained in process on January 31 with material fully supplied and labor averaging 50% complete.

The books were not closed on January 31, and after the transfer of completed units was made it was discovered that manufacturing overhead in January, 1953, and in prior periods was actually 60% of direct labor cost.

Required:

a) Set up a work in process account for Process A showing total and unit material, labor, and manufacturing overhead for units completed and for units in process at end.

b) Prepare the correcting journal entry.

6–4. The Union Solvents Company produces ethyl alcohol from molasses bought in the West Indies by a totally owned subsidiary, the West Indies Molasses Company. The latter contracts for the output of various sugar companies on a crop basis, sells part of it in the islands at a small profit, and the remainder to the alcohol company at net cost, settlement being made at the close of the year.

The molasses is held in storage until transported, in tankers owned by the molasses company, directly to the alcohol company's plant in the United States.

The molasses company contracted for the 1951 and 1952 crops of molasses at 4 cents per gallon of 50% sugar content, the purchase price to be adjusted on that basis.

The following operating data are given:

	Molasses 1,000 gals.	Sugar Content
West Indies inventory, December 31, 1951	43,200	51%
Receipts of 1951 crop in 1952	2,400	50%
Receipts of 1952 crop	240,000	52%
Sales of molasses in West Indies, on the basis of $7.33⅓ per 1,000 lbs. of 50% sugar content	96,000	52%
West Indies inventory, December 31, 1952	33,600	52%
Shrinkage en route from West Indies to the alcohol company's plant in the United States	6,000	

	Molasses 1,000 gals.	Sugar Content
Sugar content of molasses delivered at alcohol company's plant in the United States		50%
United States inventory, December 31, 1951, valued at $776,318	14,400	49%
United States inventory, December 31, 1952	4,400	50%

Sundry income in West Indies	
Net proceeds from sales of supplies	$ 96,384.00
Revenue from cargo carried on vessels	220,000.00
Cost of operating vessels	2,221,240.00
Sundry expenses in West Indies	715,406.00
United States expenses incident to the purchase of molasses in West Indies	172,786.00
Average weight of one gallon of molasses	12 lbs.

Prepare statements showing the cost of molasses (*a*) delivered at the alcohol company's plant and (*b*) used in the production of alcohol. Show unit costs per 1,000 gals. of molasses and 1,000 lbs. of sugar content.

(Adapted from an American Institute of Accountants examination)

6–5. The P.A.R. Company is engaged in manufacturing a single product and uses a process cost system.

The production of the company is carried on in two production departments identified as Department 1 and Department 2. However, while overhead is allocated to Department 1 in total and is applied on a labor dollar basis to production of the department, the cost of direct labor is accumulated for each of two separate processes performed within the department, which processes are identified as A and B. Material is used at various stages of production as follows: Material L is placed in process at the beginning of work in Department 1 (i.e., at the beginning of Process A); Material T is put into the process at the beginning of the second process (Process B) in Department 1; no material is added in Department 2. When the production of Process A reaches Process B, it is mixed with Material T.

Costing of production is on a pound basis in Department 1, but on a unit basis in Department 2. A unit has a weight of 80 lbs. at the start of processing in Department 2. There is a weight loss in Department 1, all of which takes place in the second (B) process. There is a normal loss of units in Department 2 due to units being found to be defective upon final inspection in the department. These defective units have no salvage value.

The following data cover the operations for the month of October, 19—:

Department 1

	Work in Process October 1 (lbs.)	Work in Process October 31 (lbs.)	Transferred to Department 2
Process A	2,000	3,000	–
Process B	4,000	2,000	36,000 lbs.

During October, 25,000 lbs. of Material L costing $4,250 were issued to Process A, and 12,000 lbs. of Material T costing $2,720 to Process B.

Labor cost during October for Process A was $13,832 and for Process B was $14,878. Overhead is 100% of labor cost. Work on the inventory in Process A as of October 1 had been 40% completed. The cost of material, labor, and overhead had amounted to $1,284. The inventory in Process B had been 60% completed in that process and had an accumulated total cost of $5,384. The inventories on October 31 were 50% complete in both processes.

Department 2

In Department 2 there were 250 units in process on October 1 which were estimated to be 50% completed. Their accumulated cost was $70,001.20. During the month the cost of labor was $53,560, and overhead was applied at 150% of labor cost. During October, 500 good units were completed, of which 400 were transferred to finished goods. There are also 160 unfinished units in the department on October 31 which are ⅝ complete as to this department.

Required:

a) You are to prepare a summary of costs and production for October, and a summary schedule of inventory values by departments at October 31. In costing units out of each department, use the first-in first-out basis.

b) Also present the process cost accounts for Process A, Process B, and Department 2, showing both quantities and dollar amounts in each account.

(*Adapted from an American Institute of Accountants examination*)

6–6. The Genesee Brick Company commenced operations January 1, 19—, in a newly purchased and fully equipped plant. The opening trial balance was as follows:

Cash	$13,200.00	
Clay Lands	40,000.00	
Plant and Equipment—Machine-made Brick	13,000.00	
Building and Equipment—Hand-made Brick	6,000.00	
Power Plant	1,800.00	
Kilns	16,000.00	
Capital Stock		$90,000.00
	$90,000.00	$90,000.00

Clay is mined and stored until needed, when it is fed to the brick and tile departments. Machine-pressed brick and hand-molded brick and tile are manufactured.

Under the cost accounting system installed, the cost of the two classes of product is determined separately. The various departmental foremen make daily reports, a summary thereof for the month of January being as follows:

Clay mines	6,800 tons clay mined.
Machine-made brick	850,000 9-in. bricks molded.
Handmade brick and tile	320,000 9-in. bricks (or equivalent) molded.
Kilns	810,000 machine-made bricks set in kilns.
	780,000 machine-made bricks drawn from kilns, of which 35,000 are broken.
	300,000 handmade bricks set in kilns.
	290,000 handmade bricks drawn from kilns, of which 15,000 are broken.

The voucher record charges for January are:

General plant expenses—yard supplies	$ 190.00
Power house—fuel, supplies, and repairs	370.00
Clay mining—powder, supplies, repairs	2,380.00
Machine-made brick—supplies and repairs	850.00
Handmade brick—supplies and repairs	460.00
Kilns—fuel, supplies, and repairs	1,695.00

The payrolls for the month are analyzed as follows:

General plant expense—superintendent	$ 160.00
Watchmen and yard employees	240.00
Engineers and firemen	330.00
Clay miners	1,200.00
Machine-made brick molders	1,200.00
Handmade brick molders	980.00
Kilns—setting, firing, drawing	1,410.00

Depletion of clay lands and depreciation of capital assets are to be provided for as follows:

Depletion—clay lands	4% per annum
Depreciation—power plant	6% per annum
kilns	
machine-made brick molding	
handmade brick molding	

A reserve for extraordinary kiln repairs is to be provided for at 24 cents per 1,000 bricks set in kilns.

The power used at the clay mines is 30 horsepower, and at the machine-made brick plant 45 horsepower.

The general plant expense will be absorbed by the departments in proportion to the labor in each.

It is estimated that since the handmade bricks require more careful handling and setting, the cost of burning in kilns is 30% more than that of machine-made bricks.

Five and one-fourth tons of clay are required per 1,000 bricks.

Broken bricks are valued at their weight as clay.

Bricks remaining in the kilns at the end of the month are assumed to average one half burned.

Required: Present a process cost sheet showing inventories and transfers for each class of product as of January 31.

6-7. The following operating figures are obtained from the books of the March Manufacturing Company at December 31, 19—:

Sales	$903,900.00
Purchases	418,052.00
Processing labor	88,000.00
Processing burden	132,000.00
Baling labor and expense	4,104.00
Selling and general expense	126,732.00
Interest expense	4,902.00
Discount on sales	1,600.00
Federal income taxes	69,000.00
State income taxes	13,000.00

The company was organized on January 1, 19—, to process certain waste material from textile mills. Most of the material processed by the company was purchased by it, but during the year it has processed some materials under a contract with another company.

The material which it processes on a contract basis is consigned to the company. When complete it is billed back to the accommodated company at a processing charge per pound. The same number of pounds received is billed back, and the charge includes an amount charged for baling as well as for processing. The material processed on a contract basis can be identified, and losses in process are borne by the owner of the material, which are the same percentage of material processed as applies to material consumed in processing merchandise for sale. Such losses occur after the material has been processed, but before baling, and are due to discarding substandard production. Discarded material processed under contract is returned unbaled to the owner. The company makes a practice of selling its discarded product unbaled as it is set aside.

The two departments of the company are Processing and Baling. After coming from the processing department, the material is baled, using 400 lbs. of processed material to the bale. Costs are separated by departments, and the amounts given above include the cost of processing and baling the merchandise for sale and also the merchandise manufactured for other concerns. A fraction of a bale is considered to cost as much for baling as a full bale.

An analysis of the sales account reveals the following facts:

Sales of finished product—4,200 bales	$840,000.00
Sales of contract goods—360,000 lbs. at $.15 processing charge	54,000.00
Sales of scrap material	9,900.00
	$903,900.00

The purchases account shows debits for 2,080,000 lbs. of material at $.20 per lb. The remaining amount shown in the account is for material used in baling the product.

In addition to the finished product sold, the company manufactured 75 bales of finished product which remain on hand. The inventory of material on hand December 31, 19—, amounts to 200,000 lbs. The goods in process weigh 80,000 lbs. and are 50% complete in the Processing Department. There is no inventory in the Baling Department and there is no contract work in process at December 31.

You are to prepare a formal statement of profit and loss for the year. This should be supported by a detailed statement of cost of goods sold and a process cost statement in tabular form showing costs and transfers by processes.

(*Adapted from an American Institute of Accountants examination*)

CHAPTER 7

7-1. The Quality Canning Company, Inc. capitalizes all charges relative to the purchase of raw materials which are used in the canning of their products. Purchase discounts are deducted at the time invoices are received. Determine the value of the inventory of the different items as a result of the following transactions. Show the unit cost per thousand at which these items are to be carried in the stock ledger.

On March 2, an invoice was received from the Allegheny Can Company for a carload of 180,000 Type 70 L cans billed at $19.40 per M, terms 1/10 n/30, f.o.b. plant.

On March 9, an invoice was received from the Muirman Label Co. for 1,000,000 labels billed at $1.68 per M, terms 1/10 n/20, f.o.b. delivered.

On March 12, a freight bill was received from the Pennsylvania Railroad for the carload of cans, 38,900 lbs. at $.87 per cwt. plus 3% tax.

On March 15, an invoice was received from the American Cardboard Company for 25,000 cartons for packing 24 cans each at $20.45 per M, weight 8 oz. to a unit; and 15,000 cartons for packing 48 cans each at $25.15 per M, weight 12 oz. to a unit, terms 2/10 n/30, f.o.b. plant.

On March 16, a demurrage charge was received from the Pennsylvania Railroad for $14.50 plus 3% tax. This charge is the result of a two-day delay in unloading the carload of cans.

On March 21, a freight bill was received from the Pennsylvania Railroad for the cartons, 23,750 lbs. at $1.12 per cwt. plus 3% tax.

During February the purchasing department's overhead was $21,200. Purchases for the month of February amounted to $265,000. Determine overhead rate and apply it to March purchases.

Other purchases for the month of March were $215,250. Actual purchasing department overhead for the month was $17,935. Indicate the amount of the over- or underapplied purchasing department overhead and make a journal entry disposing of this item.

7–2. The Perlman Company uses Formanite in the manufacture of its product. The information shown below was the result of a study of the requirements for this material:

Average daily requirement	20 lbs.
Maximum requirement for 30-day period	900 lbs.
Minimum requirement for 30-day period	200 lbs.
Most economical order	1,500 lbs.
Time required to obtain delivery	30 days

Required:

a) At what point should an order be placed?
b) What will be the minimum quantity of Formanite on hand at any time?
c) What will be the maximum quantity of Formanite on hand at any time?

7–3. The Metal Specialties Company proposes to charge materials to producing departments at a cost which will include invoice price, freight-in, cost of purchasing, cost of receiving, inspecting, and storing as well as the cost of issuing and delivering the goods to the department requisitioning the materials.

It is estimated that for the coming year purchases of materials will amount to $900,000. It is expected that the other costs relative to handling materials will be as follows:

Purchase Department cost	$10,600.00
Freight-in	9,200.00
Receiving Department cost	5,100.00
Inspection and Specification Department cost	6,400.00
Storing Department cost	9,900.00
Stores record keeping	3,800.00
	$45,000.00

From the summary of completed stores requisitions for January it is noted that direct materials were used by the producing departments as follows:

Producing Department A	Invoice price	$30,000.00
Producing Department B	Invoice price	25,000.00
Producing Department C	Invoice price	24,000.00

From other summaries prepared at the end of January it was found that the costs relative to materials were as follows:

Purchase Department cost	$990.00
Freight-in	750.00
Receiving Department cost	420.00
Inspection and Specification Department cost	590.00
Storing Department cost	860.00
Stores record keeping	380.00

Required:

a) Calculate the rate for applying materials handling overhead.

b) Prepare the entry for costing materials to work in process for January and to set up the actual materials handling overhead.

c) Determine the amount of the over- or underabsorbed material handling burden and explain what disposition is made of this balance.

CHAPTER 8

8–1. The Whisket Brush Company manufactures various types of brushes which use a No. 3 type plastic bristle as one of the raw materials. A perpetual inventory record is maintained. This record utilizes sections for quantities ordered, apportioned and available, besides the usual sections for receipts, issues and balance.

The minimum quantity is 3,000 lbs. and the automatic ordering quantity is 5,000 lbs. The opening inventory on September 1, 19— was 3,400 lbs. valued at 4.3¢ per pound. The available balance was also 3,400 lbs.

All material requisitions are filed with the storeroom three days before they are scheduled to be used in production. Consider that the production schedule is maintained without interruption.

The following orders were placed during the month of September, 19—.

Date	Order No.	Quantity (Lbs.)
September 2	4012	1,400
September 9	4013	1,500
September 11	4014	2,000
September 16	4015	1,600
September 20	4016	1,800
September 22	4017	2,300
September 30	4018	1,300

Whenever the available balance falls below the minimum quantity, notification is sent to the purchasing department which sends a purchase order to the vendor, Acme Plastic Corp., the next day. The purchasing department was able to place orders at 4.5¢ a pound up to and including September 15, at 4.8¢ up to and including September 25, and thereafter the cost was 5.0¢. Consider an order as having been received one week after having been placed. Use purchase order number 9-128, 9-129, etc.

Required:

a) Show the inventory card as it appears on September 30, 19—. Transactions are to be shown in chronological order.

b) Show the value of the inventory on September 30, 19— if

(1) Stores were issued at average cost.

(2) Stores were issued on the first-in first-out basis.

8–2. From the following data and information, cost the sales and inventories according to the last-in first-out method of pricing.

Arrange data of your solution in columnar form as follows:

1. Line number
2. Year and month
3. Opening Inventory (Quantity)
4. Production or Purchases (Quantity, Unit Price, and Cost)
5. Cost of Sales (Quantity, Unit Price, and Cost)
6. Closing Inventory (Quantity, Unit Price, and Cost)

The data are:

January 1, 1950 Inventory 1,000 units at $.40

	Production or Purchases	Units Sold
January, 1950	2,500 at $.35	2,000
February	2,250 at .32	2,000
March	2,000 at .30	3,000
April	2,000 at .31	1,500
May	2,500 at .35	1,500
June	2,250 at .40	2,750
July	1,750 at .42	2,500
August	1,750 at .43	2,000
September	2,500 at .45	2,250
October	2,400 at .44	2,000
November	2,100 at .43	2,500
December	2,250 at .45	2,000
January, 1951	1,800 at .44	1,900
February	2,000 at .41	2,250
March	2,500 at .38	2,000

Calculate unit costs to four places beyond decimal, rounding off at the fourth place.

Note: So long as the quantity on hand is not in excess of the opening inventory for the year, the closing inventory price will be the same as the opening inventory price.

At the end of any month, if the quantity on hand exceeds the opening inventory for the year, such excess will be priced at the average to date of production or purchase cost.

This company operates on a calendar year basis.

8–3. The stores inventory of the Stanley Corporation at June 30, 19— consisted of eight items and the following values are submitted:

Item	Cost	Market Value 6/30/19—
A	$5,000.00	$4,000.00
B	4,000.00	4,500.00
C	2,300.00	2,300.00
D	4,800.00	5,100.00
E	3,600.00	2,100.00
F	2,350.00	2,350.00
G	4,130.00	4,690.00
H	5,210.00	4,210.00

a) Show the inventory value at June 30, 19— assuming the use of the cost or market, whichever is lower, basis of valuation. Prepare the journal entry to place this value on the books.

b) What additional entry or entries would be required for part (*a*) if it is assumed that prices in the period after June 30 will decline 15% below prices at June 30. Submit computations for values used.

c) What effect would the entries in parts (*a*) and (*b*) have on the following statements:

1. Balance sheet
2. Cost of production
3. Stores ledger

d) What disposition would be made of the accounts created by the entries in (*a*) and (*b*) above?

8–4. *a*) From the following information prepare a stores ledger card for "Hextone," as of June 30, 19—.

June 1, 19—	Inventory and available balances 1,000 lbs. at $1.00
	Issued on Production Order 885, 100 lbs.
2	Issued on Production Order 886, 200 lbs.
	Reserved on Production Order 889, 400 lbs.
3	Issued Purchase Order 2170 for 2,000 lbs. at $1.10
4	Received shipment on Purchase Order 2170
6	Issued on Production Order 887, 1,400 lbs.
8	Reserved on Production Order 890, 600 lbs.
9	Issued on Production Order 889, 400 lbs.
11	Issued Purchase Order 2171 for 1,050 lbs. at $1.05
12	Reserved on Production Order 892, 500 lbs.
14	Received shipment on Purchase Order 2171
16	Issued on Production Order 890, 600 lbs.
17	Reserved on Production Order 893, 900 lbs.
18	Issued Purchase Order 2172 for 650 lbs. at $1.20
21	Received shipment on Purchase Order 2172
24	Issued on Production Order 893, 900 lbs.
30	Issued Purchase Order 2173 for 1,080 lbs. at $1.15

b) What are the inventory values, on June 30, 19—, under the following methods:

(1) First-In First-Out
(2) Last-In First-Out
(3) Weighted average

c) Using the above three methods; at what figure are stores issued on:

(1) June 6, 19—
(2) June 16, 19—
(3) June 24, 19—

Calculate unit costs to four decimal places.

8–5. The Doran Manufacturing Company has a cost accounting system and uses a general and a factory ledger. The following was taken from the records of the company:

1.	Issued Purchase Order M406 for direct materials	$4,200.00
2.	Issued Purchase Order M410 for parts and supplies	1,800.00
3.	Received materials on Purchase Order M406	4,200.00
4.	Received credit memorandum from vendor on Purchase Order 406 on materials returned	120.00
5.	Issued direct materials to Producing Department 40	2,140.00
6.	Received complete shipment on Purchase Order M410	1,800.00
7.	Issued supplies to repair a machine in Producing Department 41	119.00
8.	Issued supplies to Service Department 82	40.00
9.	Producing Department 41 returned excess supplies not needed (previously issued in Item 7)	15.00
10.	Issued materials and supplies to be used in construction of a special machine for Producing Department 43	850.00
11.	Paid vendor on Purchase Order M406	4,080.00
12.	Issued materials and supplies to be used in constructing display of company's products for a forthcoming industry exposition	510.00
13.	Issued materials to repair general manager's home	56.00

Required:

a) Prepare the necessary journal entries.

b) In those cases where cost controls are involved indicate the effect on subsidiary cost records, if any.

8–6. Assume in the following example that the items listed comprise the entire inventory, and the additions and deductions shown are a summary of all the transactions in the inventory accounts:

	Units			
Inventory	Balance at Beginning of Year	Purchased or Produced	Sold, Used, or Transferred	Balance at End of Year
Item 1	50,000	600,000	580,000	70,000
Item 2	48,000	1,200,000	1,210,000	38,000
Item 3	100,000	1,312,000	1,285,000	127,000
Item 4	80,000	1,415,000	1,390,000	105,000

Assume that, depending upon the basis of valuation used, the following unit prices or costs had been determined, in respect of each item for each basis for the beginning inventory for the year:

	Basis			
Inventory	Average Cost	Cost FIFO	Cost LIFO	Market or Current Cost
Item 1	$ .23	$ .25	$ .20	$ .30
Item 2	1.80	2.00	1.40	2.10
Item 3	14.00	17.50	12.50	16.00
Item 4	42.00	42.00	41.00	40.00

Following are acquisitions during the year and market prices at the end of the year:

Inventory		Date	Quantity	Unit Cost
Item 1		1/20	300,000	$ .30
		3/18	250,000	.40
		9/15	50,000	.55
	Market	12/31		.60
Item 2		2/8	400,000	2.00
		7/16	500,000	2.05
		9/10	300,000	2.10
	Market	12/31		2.00
Item 3		3/31	300,000	16.50
		4/25	400,000	17.00
		8/18	450,000	17.50
		12/15	162,000	18.50
	Market	12/31		17.50
Item 4		1/25	600,000	40.00
		4/28	480,000	38.00
		8/27	335,000	36.00
	Market	12/31		36.00

Disposals (sold, used or transferred) in units, were accounted for quarterly during the period as follows:

	Inventory Item			
Date	1	2	3	4
3/31	150,000	300,000	200,000	300,000
6/30	160,000	110,000	400,000	500,000
9/30	50,000	350,000	300,000	300,000
12/31	220,000	450,000	385,000	290,000
Total	580,000	1,210,000	1,285,000	1,390,000

Required: Compute value of ending inventory on each of the following bases or methods, at the amounts to be used for federal tax purposes:

a) LIFO (last-in first-out).
b) Weighted average cost.
c) Cost on FIFO basis (first-in first-out).

Apply the rule of "lower of cost or market" where appropriate in the manner commonly practiced.

Note:

1. Unit costs to be rounded off in the fourth decimal place.
2. A new weighted average must be computed after each fresh acquisition.

8–7. The E. A. P. Company is engaged in manufacturing. Its products are made principally from one raw material, and in order to insure uninterrupted production, it normally maintains a substantial inventory of the raw material. Because of advancing prices, the company in 1948 adopted the last-in first-out method of pricing out its material requisitions, and thereafter valued its inventory at the prices shown by its perpetual inventory records.

As of December 31, 1951, the inventory consisted of 380,000 pounds carried on its books at an average price of $.90 per pound. The market price at December 31, 1951, was $1.50 per pound. As of December 31, 1952, the inventory was 420,000 pounds with a market price of $1.60 per pound. This was carried at the prices shown on the stock records, 270,000 pounds of this being valued at $.90 per pound and the remainder at prices which averaged $1.54 per pound. The purchases during the year were also made at an average price of about $1.54 per pound.

The operating accounts for the year ended December 31, 1952, included the following:

Sales	$2,100,000.00
Work in Process Inventory, January 1	146,600.00
Finished Goods Inventory, January 1	90,000.00
Direct Labor	344,000.00
Cost of Material Used	1,217,000.00
Manufacturing Overhead	302,000.00
Work in Process Inventory, December 31	180,000.00
Finished Goods Inventory, December 31	100,000.00

On March 30, 1953, the warehouse in which the raw material inventory was stored was badly damaged by fire. The stock records were destroyed, but from other records the following figures were obtained:

Sales to March 30	$820,000.00
Purchases of Material	551,425.00
Direct Labor	132,400.00
Manufacturing Overhead	117,600.00
Work in Process Inventory, March 30	175,000.00
Finished Goods Inventory, March 30	105,000.00
Salvage Value of Damaged Materials	25,000.00

The purchase price of raw material during the three months had averaged $1.61 per pound with the price on March 30 at $1.62 per pound. The sales price during the period had varied only with the current material, labor, and overhead cost existing at date of acceptance of the order, as is normal in this business.

You are to determine the amount of a claim for fire loss, assuming full insurance coverage. Show all computations to support your claim.

(Adapted from an American Institute of Accountants examination)

8–8. The Charleton Manufacturing Company has a cost accounting system and uses a general and a factory ledger. The following transactions were taken from the records of the company:

1. Issued Purchase Order P207	$2,000.00
2. Received shipment from a vendor	1,500.00
3. Issued direct materials to Production Department 1	1,750.00
4. Returned materials to vendor	250.00

5. Finished parts received into storeroom from Production Department 3 .... $1,260.00
6. Production Department 1 returned excess direct materials to storeroom 125.00
7. Spoiled materials returned to storeroom from Production Department 2; total cost to this point of production $182. Scrap value $10.
8. Physical inventory of stores at end of month is $63,000. Inventory per perpetual inventory cards is $61,300.

Required:

a) Journal entries.

b) Indicate the subsidiary cost records affected by the transactions and the nature of the entry to these records, if any.

8–9. A company manufactures three main lines of machines, and the sale of replacement parts accounts for a large part of total volume.

Cost ledger trial balance at December 31, 1953, shows:

Completed product inventory	
X Machines	$100,000.00
Y Machines	200,000.00
Z Machines	300,000.00
Finished parts inventory	
X Machines	$ 50,000.00
Y Machines	100,000.00
Z Machines	200,000.00

The company has consistently valued inventory at cost or market, whichever is lower.

The scope of your examination concerning inventory has established that the cost of X and Y machines and finished parts for X and Y machines does not exceed market, considering disposal costs.

Z machines, which sell at $100 each, are valued in inventory at a manufactured cost of $80. Necessary disposal costs aggregate 25% of selling price.

An analysis of the credits to the Finished Parts Inventory Control, Z Machines, for the year ended December 31, 1953, follows:

Charged to:

Cost of Sales, Z parts	$400,000.00
Work in Process, Z machines	400,000.00

In the case of finished parts for Z machines, cost does not exceed sales price of replacement parts, less necessary disposal costs.

Required:

a) Your adjustment, if any, in connection with the valuation of the inventory of Z machines and finished parts for Z machines. (Your client specifies that adjustments, if any, be not specifically applied to the individual valuations of Z machines and individual parts for Z machines.)

b) Outline a procedure for handling adjustments, if any, in statements of operations subsequent to January 1, 1954.

CHAPTER 9

9–1. The following information is submitted relative to the payroll of the Parkay Parts Corporation for a week in October, 19—, which is the forty-second week of the year.

Employee	Pay Rate for 40-hr. Week	Hours Worked	Withholding Tax	Earnings for Year Up to Beginning of the Forty-second Week
Barlum	$150.00	40	$18.00	$6,150.00
Keynes	100.00	40	10.00	4,100.00
Chamberlin	60.00	45	3.00	2,960.00
Scott	80.00	45	4.00	4,100.00
Myers	60.00	40	0	2,600.00
Buck	60.00	48	5.00	3,550.00
Sidgewick	40.00	48	2.00	1,950.00
Bawerk	40.00	40	2.00	1,640.00
Edie	60.00	40	5.00	2,850.00

a) Prepare the payroll for the forty-second week of the year allowing columns for name, regular earnings, overtime earnings, withholding for F.I.C.A., Withholding Tax, Disability Insurance Tax (½ of 1%, maximum $.30 a week), and net pay.

b) Prepare the entry for recording the payroll in the voucher register assuming a factory ledger and that all employees except Barlum and Keynes work in the factory. Barlum and Keynes are the executives of the company.

c) Prepare the entry or entries to set up employer's payroll tax liability. The Parkay Parts Corporation has a merit rating tax rate of 1% for unemployment compensation insurance and the total cost for disability insurance is $1.08 per week per employee.

9–2. The following summary was taken from the payroll distribution sheet of the Hercules Co. for February:

Direct Labor	$78,000.00
Indirect Labor	19,000.00
Engineering Salaries	5,000.00
Factory Time Study Expense (a study is being conducted with a view toward establishing standards. This study will continue for several months.)	500.00
Administrative Salaries	2,500.00
Sales Salaries	5,000.00

The company follows the practice of setting up a reserve for vacation allowance. A total of $1,000 is to be added to the reserve for February of which $700 relates to factory personnel, $200 to sales personnel, and $100 to administrative personnel.

The following items were deducted from employees' pay:

Withholding Tax	$5,300.00
F.I.C.A. Tax at 1½%	?
Disability Insurance Tax at ½ of 1%	?
Garnishees	50.00
Hospitalization	60.00
Uniforms	12.00
Loans to Employees	65.00
Tool Kits	33.00

Prepare journal entries to:

a) Set up the liability for the payroll.
b) Pay the employees.

9–3. The following was extracted from the payroll records of Richards, Inc., for the week ended May 12, 19—.

Name	Assigned To	Hours Worked	Production (units)	Withholding Tax	Hourly Rate	Piece Rate	Weekly Rate
White, R.	Producing Dept. 1	42		$13.00	$1.50		
Thomas, P.	Producing Dept. 1	48		12.00	1.40		
Stevens, T.	Producing Dept. 2	39	2,000	13.10		$.045	
Ritner, A.	Producing Dept. 2	40	1,600	9.50		.045	
Peters, C.	Storeroom	48		5.50			$60.00*
Manning T.	Foreman, Dept. 1	40		17.80			88.00
Loring, J.	Receiving Dept.	48		.20			50.00*

* Based on 40-hr. week.

Required:

a) Prepare payroll for the week ended May, 19—, giving consideration to withholding tax, old age insurance, and a disability insurance withholding of $.30 per employee.
b) Prepare journal entries to set up the liability for the payroll, pay the payroll, and cost the payroll.

CHAPTER 10

10–1. The following is a record of the payroll of the Haskell Manufacturing Corporation, operating on a thirteen-month calendar.

For the two weeks ended January 12:

Department	Direct Labor	Indirect Labor
Winding	$149.05	$ 23.40
Processing	351.90	15.65
Finishing	315.12	34.50
Storeroom		94.50
Maintenance		40.75
Supervision		185.00
Planning		210.00
Cost and Payroll		140.00

For the two weeks ended January 26:

Department	Direct Labor	Indirect Labor
Winding	$158.40	$ 17.55
Processing	342.95	10.40
Finishing	326.67	30.15
Storeroom		94.50
Maintenance		52.15
Supervision		185.00
Planning		210.00
Cost and Payroll		140.00

Prepare:

a) A labor distribution sheet.
b) Journal entry to cost labor.
c) Journal entry to accrue employer's payroll taxes and compensation insurance as follows: F.I.C.A. 1½%, state unemployment insurance at 2.7%, and federal unemployment at .3%, compensation insurance 1%, disability insurance ½ of 1%. (Assume rates apply to total payroll with no exemptions.)

10–2. Modern Products Company employs a factory ledger. The following is a summary of transactions relative to labor for the month of October.

Four weekly factory payrolls were prepared and paid during the month. These payrolls were analyzed as follows:

Total wages and salaries	$60,000.00
Withholding income taxes	3,820.00
F.I.C.A. withheld	725.00
Disability Insurance Tax withheld	160.00
Hospitalization Insurance withheld	105.00
Group Insurance withheld	220.00

The analysis of the time tickets shows the following labor distribution:

Producing Department A	$10,000.00
Producing Department B	8,000.00
Producing Department C	7,640.00
Producing Department D	12,320.00
Service Department 1	8,030.00
Service Department 2	5,005.00
Service Department 3	9,005.00

Prepare entries in journal form to record:

a) Liability for payroll.
b) Payment of payroll.
c) Distribution of payroll.
d) Payment of federal payroll taxes (including employer's share) during November.

10–3. There are ten men working as a group on a particular manufacturing project. When the weekly production of the group exceeds a standard number of pieces per hour, each man in the group is paid a bonus for the excess production in addition to his wages at hourly rates. The amount of the bonus is computed by first determining the percentage by which the group's production exceeds the standard. One half of this percentage is then applied to a wage rate of $1.25 to determine an hourly bonus rate. Each man in the group is paid, as a bonus, this bonus rate applied to his total hours worked during the week. The standard rate of production before a bonus can be earned is two hundred pieces per hour.

On the basis of the production record stated below, compute:

a) The rate and amount of bonus for the week.
b) The total wages of Allen, who worked 40 hrs. at a base rate of $1.00 per hour, and of Knoll, who worked 39½ hrs. at a base rate of $1.50 per hour.

PRODUCTION RECORD

	Hours Worked	Production
Monday	72	17,680
Tuesday	72	17,348
Wednesday	72	18,000
Thursday	72	18,560
Friday	71.5	17,888
Saturday	40	9,600
	399.5	99,076

(Adapted from an American Institute of Accountants examination)

10–4. The following payroll information is submitted by the Brass Bolt Company for the week ending March 15, 1952.

RECAPITULATION OF JOB-TIME TICKETS

FOR THE WEEK ENDING MARCH 15, 1952

	Clock No.	Job No.	Hours	Rate	Payroll
William Bevans	1487	2087	20	$1.50	$30.00
		2152	18	1.50	27.00
		None	2	1.50	3.00
Elmer Cass	438	2146	40	1.85	74.00
Thomas Debel	1224	2137	35	1.65	57.75
		None	5	1.65	8.25
John Granger	1517	2078	27	1.50	40.50
		2152	13	1.50	19.50
Peter Holmes	743	2078	25	2.00	50.00
		2146	10	2.00	20.00
		None	5	2.00	10.00
Sam Jasper	847	2100	10	1.70	17.00
		2137	30	1.70	51.00

	Clock No.	Job No.	Hours	Rate	Payroll
Wilbur Karr	923	2100	15	$1.75	$26.25
		2137	24	1.75	42.00
		None	1	1.75	1.75
Horace Pranz	1212	2146	38	1.85	70.30
		None	2	1.85	3.70
Fred Rodriguez	147	2137	35	1.90	66.50
		2152	4	1.90	7.60
		None	1	1.90	1.90
Milo Spatter	492	2137	40	1.75	70.00
Stanley Zybawski	826	2100	20	1.95	39.00
		2137	17	1.95	33.15
		None	3	1.95	5.85

Time not charged to specific jobs is considered to be indirect labor because such time is usually devoted to maintenance of plant and machinery.

Payroll taxes are to be computed as follows:

State Unemployment Insurance	2.7%
Federal Unemployment Insurance	0.3%
F.I.C.A. Tax—Employer	1.5%
F.I.C.A. Tax—Employee	1.5%

Assume that 20% is withheld from wages for federal income tax.

Required:

a) Journal entries to record accrued payroll, distribution of payroll to Work in Process, and Manufacturing Overhead, and Provision for Unemployment and F.I.C.A. taxes when:

(1) Unemployment and F.I.C.A. taxes are treated as manufacturing overhead.

(2) These taxes are considered to be a direct labor cost when the time is chargeable to a specific job.

b) Indicate the direct labor cost of each job under both methods.

Note: Indicate specific accounts when charging items to Manufacturing Overhead Control.

CHAPTER 11

11–1. The Excelsior Manufacturing Company commenced business on January 1, 19—, with a paid-up capital of $2,000,000. It has a system of cost accounts which are controlled by the general books.

The trial balance of the company on December 31, 19—, was as follows:

Cash	$ 30,000.00
Accounts Receivable	130,000.00
Notes Receivable	25,000.00
Raw Materials	150,000.00
Manufacturing Overhead	–
Work in Process	100,000.00

Finished Goods	$ 300,000.00	
Dividends Paid	70,000.00	
Plant and Machinery	1,369,750.00	
Profit and Loss		$ 23,250.00
Interest on Plant Investments		60,000.00
Accounts Payable		41,000.00
Notes Payable		500.00
Allowance for Depreciation		50,000.00
Capital Stock		2,000,000.00
	$2,174,750.00	$2,174,750.00

The general books of the company show charges and credits to Manufacturing Overhead as follows:

MANUFACTURING OVERHEAD ACCOUNT

Factory Executive Salaries (one third)	$ 15,000.00
Indirect Labor	30,000.00
Cost Department Salaries	10,000.00
Superintendents' Salaries	10,000.00
Repairs of Machinery and Buildings	25,000.00
Power	5,000.00
Factory Supplies and Expenses	5,000.00
Interest on Plant and Equipment	60,000.00
Salesmen's Salaries	20,000.00
Advertising	30,000.00
Salesmen's Expenses	10,000.00
Freight Outbound	10,000.00
Shipping Department—Labor and Expense	15,000.00
Officers' Salaries (executive, two thirds)	30,000.00
Office Salaries—Clerks	15,000.00
Office Expense	5,000.00
Cash Discount on Sales	15,000.00
Interest on Notes Payable	10,000.00
Allowance to Customers	10,000.00
Bad Debts	5,000.00
Depreciation on Plant and Machinery	50,000.00
Total	$385,000.00
Credit—Cash discounts on purchases	10,000.00
Burden applied to work in process during the year (equal to 100% of direct labor)	$375,000.00

On examination of the accounts, you find that the purchase of raw materials during the year amounted to $500,000; that the cost of direct labor was $375,000; and the sales amounted to $723,250.

An analysis of the work in process discloses the following charges:

Materials	$ 25,000.00
Direct Labor	37,500.00
Manufacturing Overhead (100% direct labor)	37,500.00
Total	$100,000.00

The number of units completed and delivered to the warehouse was 100,000, and of this number 70,000 units were sold.

You find that a dividend of 3½% was declared during the fiscal year and that no entry has been made.

Required: You are to prepare a balance sheet, profit and loss statement, and cost of production statement showing the cost and net profit per unit.

11–2. The Clermont Machine Manufacturing Company needed a cutting machine to use in cutting gears. Accordingly it asked for bids from several good machinery manufacturers. When the bids were opened it was found that they ranged from $7,500 to $9,000. Believing it could do better in its own shop the company refused all the bids and ordered the machine built in its own plant. When the machine was completed it was found that it had cost $4,000 in material and direct labor cost, and that the material amounted to 60% of the direct labor cost. For the month during which this machine was constructed, costs for the plant were:

Materials	$ 720,000.00
Direct Labor	1,200,000.00
Manufacturing Overhead	480,000.00
Selling and Administrative Expenses	150,000.00

What entry or entries should be made to set up the machine on the books at its proper value?

11–3. Rex Parts Manufacturing Company follows the policy of charging interest on plant investment as a cost of production.

The following information was derived from the records of the company at the end of the fiscal year June 30, 19—.

Materials in Process	$ 16,000.00
Labor in Process	2,000.00
Manufacturing Overhead in Process	2,000.00
Finished Goods	60,000.00
Cost of Goods Sold	200,000.00

Assume no beginning inventories and that in the course of the year work in process was charged with

Direct Material	$120,000.00
Direct Labor	80,000.00
Manufacturing Overhead (including $10,000 interest on plant investment)	80,000.00

Required:

a) Entry to adjust for interest on plant investment.
b) Statement of cost of goods sold.
c) What disposition is made of the allowance for interest on plant investment?

11–4. An examination of the insurance carried by the Zorro Corporation revealed the following policies on hand on December 31, 1952.

Date of Policy	Term	Coverage	Company	Policy No.	Face of Policy	Unexpired Premium at 12/31/52
1/15/52	3 yrs.	Fire—Building	Travelers	T46934	$150,000.00	$1,500.00
7/ 1/52	2 yrs.	Fire—Building	Landlords	F9612	75,000.00	375.00
11/ 1/52	3 yrs.	Fire—Contents	National	N96123	200,000.00	3,200.00
10/ 1/52	1 yr.	Fire—Trucks	Travelers	196431	30,000.00	90.00
4/ 1/52	2 yrs.	Public Liability Property Damage—Trucks	Farmers' Mutual	8375L	50,000.00— 100,000.00, 20,000.00	525.00
3/ 1/51	3 yrs.	Sprinkler—Warehouse	Phoenix	S1492	25,000.00	125.00
11/ 1/51	2 yrs.	Bond—Office	U.S.Tr.G.	B469140	20,000.00	35.00
12/ 1/52	1 yr.	Hold-up	Aetna	U14967	5,000.00	120.00

Required: Prepare journal entry to charge insurance for the month of January, 1953. An apportionment should be made to the manufacturing, selling, and administrative divisions of the business.

CHAPTER 12

12–1. The Jones Manufacturing Company produces its own power and the power department incurred the following expenses during the month of January:

Indirect Labor	$450.00
Fuel	600.00
Supplies	50.00
Materials	40.00
Repairs of Boilers	75.00
Repairs of Equipment	25.00

The apportioned charges to power department were:

Depreciation	$ 45.00
Building Expense	120.00
Taxes	35.00
Insurance	30.00
Factory Administration	70.00

The amount of power consumed by the various departments was as follows:

Department	Horsepower-Hours
Producing Department A	1,000
Producing Department B	2,100
Producing Department C	3,900
Producing Department D	6,600
Producing Department E	6,600
Service Department F (Tool)	950
Service Department G (Pattern)	850

Required:

a) Expense statement of power department.
b) The departmental unit cost per horsepower-hour.
c) Journal entry (assuming departmental accounts carried in general ledger).

12–2. The total expenses of four service clearing accounts in a certain process plant, before clearance has been made to the other accounts within this group are as follows:

Steam plant expense	$ 523.00
Pumping plant expense	170.00
Water plant expense	106.00
Electric plant expense	201.00
Total	$1,000.00

The expenses as above shown are fairly allocable to each other and to all other departments and process costs in the following ratios:

Allocable to

Plants	Steam	Pumping	Water	Electric	All Other
Steam	–	8%	4%	19%	69%
Pumping	9%	–	17%	3%	71%
Water	22%	3%	–	2%	73%
Electric	5%	18%	–	–	77%

Required:

a) Calculate the service department expenses chargeable to the other departments or processes. (Compute to *three* decimals.)
b) Show the completed ledger accounts for each department and for "All Other Departments."

12–3. The Ajax Manufacturing Company has the following account balances and distribution of direct charges at March 31, 19—.

		Producing Departments		Service Departments	
	Total	Machine Shop	Packing	General Plant	Stores and Maintenance
Direct Charges:					
Indirect Labor	$ 1,465.00	$400.00	$300.00	$ 200.00	$565.00
Maintenance Materials	502.00	180.00	70.00	102.00	150.00
Miscellaneous Supplies	175.00	40.00	100.00	15.00	20.00
Superintendent	400.00			400.00	
Cost and Payroll, Salaries	1,000.00			1,000.00	
Indirect Charges:					
Purchased Power	800.00				
Rent	1,200.00				
Fuel and Heat	600.00				
Insurance	100.00				
Taxes	200.00				
Depreciation	10,000.00				
Totals	$16,442.00	$620.00	$470.00	$1,717.00	$735.00

The following data were compiled by means of a factory survey and study made in the previous year:

	Floor Space	Radiator Sections	Number of Employees	Investment	HP.-hrs.
Machine Shop	2,000	45	20	$ 64,000.00	3,500
Packing	800	90	10	20,000.00	500
General Plant	400	30	3	1,000.00	–
Stores and Maintenance	1,600	60	5	15,000.00	1,000
	4,800	225	38	$100,000.00	5,000

Expenses charged to the Stores and Maintenance Department are to be distributed to the other departments by the following percentages: Machine Shop 50%; Packing 16⅔%; General Plant 33⅓%. General Plant overhead is distributed on basis of number of employees.

Required:

a) Prepare an overhead distribution sheet with supporting schedules to show computations and bases of distribution including a distribution of the service department expenses to the producing departments. Determine the service department distributions by:
  (1) The application of simultaneous equations. Show all computations.
  (2) The method of continued distribution. Carry through five cycles. Show all computations to three decimal places; round off grand totals to nearest cent.

b) Show the completed ledger accounts.

12–4. The Alto Manufacturing Company employs departmental burden rates for applying overhead to production. A summary of the estimated annual overhead budget for the coming year is scheduled below together with the annual estimates for direct labor hours and machine hours.

	Estimated Annual Overhead	Maintenance Labor Included in Overhead	Estimated Direct Labor Hours	Estimated Machine Hours
Machine Shop	$ 68,000.00	$ 4,000.00	100,000	150,000
Forge	45,000.00	2,000.00	70,000	
Bench Assembly	35,000.00	1,000.00	40,000	
Receiving and Stores	15,000.00	1,000.00		
Building Service	28,000.00	3,000.00		
Powerhouse	40,000.00	1,000.00		
Maintenance	24,000.00	1,000.00		
Cost and Payroll	30,000.00			
Engineering	25,000.00			
Supervision	20,000.00			
	$330,000.00	$13,000.00	210,000	150,000

The following statistical information is available:

	Floor Space (sq. ft.)	No. of Employees	Receiving and Stores Expense Apply to	Power-house Expenses Apply to	Engineering Expenses Apply to
Machine	25,000	40	30%	40%	45%
Forge	25,000	30	30%	20%	30%
Bench Assembly	20,000	15	15%	10%	15%
Receiving and Stores	12,000	5	10%	30%	
Building Service	2,000	5	10%		10%
Powerhouse	20,000	4	5%		
Maintenance	5,000	3			
Cost and Payroll	4,000	10			
Engineering	7,000	4			
Supervision	2,000	3			
	122,000	119	100%	100%	100%

Careful studies made of materials handled, horsepower utilized, and time estimates are used as a basis for computing the above percentages for distributing overhead charged to the Receiving and Stores, Powerhouse, and Engineering Departments.

Required: Prepare a work sheet showing the distribution of estimated service department expenses for the year to the producing departments. Distribute the service departments in order of size of balance after each apportionment. Do not reopen them once they are closed.

CHAPTER 13

13–1. In order that manufacturing overhead rates may be computed for the ensuing year the Elliott Manufacturing Company's cost accountant has compiled the following information:

Account	Amount	Dept. 1	Dept. 2	Dept. 3	Dept. 4
Supervision	$ 600.00	Equally over all departments			
Indirect Labor	2,900.00	20%	25%	30%	25%
Repairs	885.00	10%	30%	30%	30%
Supplies	1,270.00	15%	15%	25%	45%
Experimental Expense	230.00	Equally over all departments			
Patent Expense	1,000.00	Equally over all departments			
Depreciation	725.80	$177.40	$95.40	$297.40	$155.60
Sundry Expense	395.00	Equally over all departments			
Light and Heat	210.00	20%	30%	25%	25%
Liability Insurance	225.00	40%	25%	15%	20%
Fire Insurance	97.58	$24.00	$15.80	$36.00	$21.78
Power	2,700.00	40%	40%	15%	5%
Taxes	243.00	$59.97	$39.49	$89.97	$54.52
Stores and Receiving	616.90	$462.68	.....	$154.22	.....
General Factory	247.50	Equally over all departments			
Building Expense	232.00	20%	20%	30%	30%
Elevator Expense	248.68	Equally over all departments			
Total	$12,827.41				
Normal Machine Hours		1,100	.....	3,000	
Normal Direct Labor Hours		.....	2,600		
Normal Direct Labor Cost		.....	.....	. .	$2,200

Required:

a) Prepare a manufacturing overhead distribution sheet.
b) Compute rates for applying manufacturing overhead.

13–2. The general ledger after the books were closed showed the following balances of the Cornell Manufacturing Company, December 31, 19—:

Cash	$ 7,000.00	
Accounts Receivable	20,000.00	
Stores	8,000.00	
Work in Process	3,500.00	
Finished Goods	11,500.00	
Machinery and Equipment	25,000.00	
Prepaid Insurance	300.00	
Vouchers Payable		$ 9,000.00
Accrued Payroll		225.00
Taxes Accrued		150.35
Capital Stock		50,000.00
Retained Earnings		15,924.65
	$75,300.00	$75,300.00

The Cornell Manufacturing Company has been applying manufacturing expense on the blanket rate method and the controller who recently took up his duties with the concern pointed out to Mr. Cornell, the president, the futility of such a procedure. It was therefore decided to divide the plant into departments numbered 1 to 7, inclusive. The first five to be producing departments and the last two to be service departments.

During the month, transactions were as follows:

1. Stores purchased, $4,125.25.
2. Stores withdrawn amounted to:

Direct Materials	$5,625.50
Indirect Materials	1,114.10
	$6,739.60

3. The indirect material requisitions were analyzed and charged to the following departments:

Department	Amount
1	$ 317.50
2	230.20
3	104.25
4	117.80
5	125.10
6	120.00
7	99.25
	$1,114.10

4. The total payroll for the month was:

Direct Labor	$4,110.25
Indirect Labor	1,725.30
	$5,835.55

5. The analysis of time tickets showed departments affected as follows:

Department	Amount
1	$ 115.70
2	270.10
3	102.25
4	225.75
5	304.15
6	475.35
7	232.00
	$1,725.30

6. The amount of payroll disbursed during the month amounted to $5,510.25.

7. Manufacturing overhead incurred during the month other than materials, labor, and fixed charges were $2,117.20. This amount was distributed to the departments as follows:

Department	Amount
1	$ 325.25
2	250.50
3	410.15
4	125.35
5	407.25
6	410.10
7	188.60
	$2,117.20

8. The schedule of fixed charges was as follows:

Department	Depreciation	Insurance	Taxes	Rent	Total
1	$ 42.10	$17.75	$ 20.10	$ 45.25	$125.20
2	30.15	16.25	18.40	51.15	115.95
3	61.20	15.10	30.20	40.35	146.85
4	37.15	18.25	23.10	42.70	121.20
5	22.25	4.10	2.20	65.85	94.40
6	16.70	10.15	2.15	52.15	81.15
7	15.55	9.55	6.00	17.55	48.65
	$225.10	$91.15	$102.15	$315.00	$733.40

9. The totals of the Service Departments 6 and 7 were apportioned over the producing departments as follows:

Department	Dept. 6	Dept. 7	Total
1	$ 210.10	$102.15	$ 312.25
2	295.25	125.00	420.25
3	215.35	95.25	310.60
4	205.15	125.15	330.30
5	160.75	120.95	281.70
	$1,086.60	$568.50	$1,655.10

10. The applied manufacturing overhead charged to production during the month amounted to:

Department	Amount
1	$1,205.10
2	1,250.30
3	995.20
4	889.10
5	1,190.50
	$5,530.20

11. The production for the month was $11,221.25.
12. The cost of sales during the month was $15,250.31.
13. The sales were $24,702.35.
14. Selling expense of $3,772.10 and administrative expense of $2,895.25 were incurred during the month.
15. Settlements from customers amounted to $19,201.10 less 2%.
16. Creditors' accounts in the amount of $12,415.07 less 2% were paid.

Note: Close out any over- or underapplied manufacturing overhead to cost of sales.

Required:

a) Journal entries.
b) Ledger accounts for cost controls.
c) Statement of production cost.
d) Statement of profit and loss.

Note: In lieu of a departmental expense ledger, set up a manufacturing overhead distribution sheet.

13–3. The Cooper Manufacturing Company operates a cost system and applies manufacturing overhead to the cost of orders on the machine hour rate method. There are three cost centers with two machines in each center. The predetermined machine hours are, respectively, for centers A, B, and C: 2,000, 1,500, and 2,000.

The analysis of the predetermined expense allocated to each machine center are as follows:

Item	A	B	C
General	$ 500.00	$ 400.00	$ 500.00
Lighting	300.00	100.00	100.00
Heating	400.00	200.00	300.00
Space cost	300.00	200.00	100.00
Taxes—Real estate	200.00	100.00	50.00
Taxes—Machinery	100.00	50.00	50.00
Insurance—Machinery	100.00	50.00	100.00
Building Repairs	200.00	100.00	100.00
Machinery Repairs	300.00	100.00	100.00
Indirect Labor	400.00	300.00	300.00
Depreciation—Machinery	500.00	400.00	400.00

Item	A	B	C
Supplies	$ 100.00	$ 100.00	$ 100.00
Power	150.00	100.00	200.00
Supervision	300.00	200.00	200.00
Tools	100.00	50.00	100.00
Insurance—Other	50.00	50.00	100.00
	$4,000.00	$2,500.00	$2,800.00

The costs of material, labor, and the machine hours for Order 1080 follow:

Item	A	B	C
Material	$100.00	$200.00	$100.00
Labor	160.00	150.00	105.00
Machine-hours	80.00	90.00	70.00
Units produced 100			

Required:

a) Compute production center machine rates.
b) Compute unit cost of Order 1080.

13–4. *a*) From the following data, illustrate six methods of applying overhead of a factory to production:

Items	Dept. A	Dept. B	Dept. C
Materials used	$10,000.00	$5,000.00	$5,000.00
Productive wages paid	$ 3,500.00	$2,200.00	$3,200.00
Productive labor hours	10,000	6,400	7,500
Indirect expenses	$ 3,800.00	$2,800.00	$3,000.00

b) Apply the results obtained in (*a*) to the facts given below for Job No. 10 in order to show the different total job costs obtained by each of the methods. Assume the material and labor (value and time) chargeable to Job No. 10 to be as follows:

Items	Dept. A	Dept. B	Dept. C	Total
Material	$10.00	$20.00	$10.00	$ 40.00
Labor value	$40.00	$45.00	$36.50	$121.50
Labor hours	40	30	30	100

13–5. Using the results obtained in Problem 4, Chapter 12, for the Alto Manufacturing Company, compute the overhead rates to be applied to the production for the coming year. It has been decided to use machine hour rates for the machine shop and the direct labor hour rate for the other producing departments.

Note: Rates are to be calculated to the nearest cent.

13–6. The Albert Manufacturing Company operates a cost system and on March 31, 19—, the following trial balance is taken from its ledger:

Material (opening inventory)	$ 3,000.00	
Material Purchases	8,084,32	
Labor (total payroll during period)	5,692.28	
Accrued Payroll (first of period)		$ 200.00

Insurance (unexpired)	828.00	
Taxes Prepaid	1,095.00	
Allowance for Depreciation		1,240.00
Work in Process	2,000.00	
Finished Goods	3,754.00	
Power	483.00	
Miscellaneous Supplies and Expenses	985.85	
Sales		13,485.60
Sales Returns	865.20	
Sales Allowances	50.00	
Outbound Freight	120.00	
Selling Expense	1,120.53	
General Office Expense	1,090.73	
Discount on Purchases		165.40
Discount on Sales	95.00	
Allowance for Bad Debts		125.00
Accounts Receivable	8,600.40	
Accounts Payable		10,233.81
Cash	11,585.50	
Land	4,000.00	
Buildings	12,000.00	
Machinery and Equipment	50,000.00	
Capital Stock		100,000.00
Unissued Stock	15,000.00	
Retained Earnings		5,000.00
	$130,449.81	$130,449.81

NOTATIONS

Cost of Sales Returns	$ 597.12
Inventories, March 31, 19—	
Material	4,600.00
Work in Process	4,024.86
Finished Goods	7,635.72
Accrued Labor	686.79

Applied Manufacturing Overhead Accounts credited as follows:

Department A: 1,802 hrs. at $.67	1,207.34
Department B: 2,523 hrs. at $.52	1,311.96
Department C: 4,418 hrs. at $.15	662.70

An account receivable of $64 from goods sold in December is considered lost; $125 should be set up for bad debt losses of the month. The distribution of the several applied manufacturing overhead items, among other accounts, is indicated in the tabulation on the following page. Vertical totals give the credits to the accounts used as columnar headings. The horizontal totals give the debits to the accounts listed at the left, which are obviously in addition to those given in the trial balance.

Required:

a) Prepare necessary journal entries including the closing entries.
b) Open cost controlling and departmental overhead accounts.
c) Prepare the balance sheet on March 31, 19—.
d) Prepare the operating statement for the month of March, 19—.

ALBERT MANUFACTURING COMPANY

ADDITIONAL DEPARTMENTAL OVERHEAD ARRANGED ACCORDING TO SUBACCOUNTS ALL OF WHICH ARE TO BE JOURNALIZED

CREDITS TO ACCOUNTS

Debits to Accounts	Labor	Building Overhead	Power	Insurance	Taxes	Allowance for Depreciation	Repairs	General Factory Overhead	Miscl. Supplies Expense	Totals
Building Overhead	$ 185.00	-	$ 84.10	$12.00	$20.00	$ 40.00	$ 65.00	-	$102.50	$ 508.60
Power	300.00	-	-	8.00	10.00	40.00	-	-	-	358.00
Repairs	356.40	-	-	2.00	2.50	13.33	-	-	215.00	589.23
General Factory Overhead	92.60	$ 76.29	-	-	-	-	-	-	299.10	467.99
Factory Overhead—Dept. A	246.50	101.72	252.30	12.00	15.00	75.00	159.00	$155.90	105.60	1,123.02
Factory Overhead—Dept. B	251.20	127.15	336.40	16.00	20.00	100.00	247.80	207.79	125.40	1,431.74
Factory Overhead—Dept. C	185.70	101.72	168.20	7.00	8.75	43.75	115.43	104.30	81.50	816.35
Shipping	117.00	50.86	-	1.00	1.25	8.33	2.00	-	56.75	237.19
General Expense (office)	-	50.86	-	14.00	16.75	8.33	-	-	-	89.94
Totals	$1,734.40	$508.60	$841.00	$72.00	$94.25	$328.74	$589.23	$467.99	$985.85	$5,622.06

CHAPTER 14

14–1. 1. The American Machine Company during the month of January began and completed the following orders: Order 315, 316, 317, 318, 319.

2. The direct materials used on these orders and unit costs were as follows:

Order No.	Kind of Material	Units	Unit Cost
315	AA	200	$.10
316	BB	550	.30
317	AA	200	.08
317	BB	100	.28
318	BB	400	.30
318	CC	5	.34
319	AA	480	.08
319	BB	120	.30

3. The direct labor used on the various orders both as to cost and hours was:

Order No.	Cost	Hours
315	$275.00	200
316	145.00	100
317	175.00	100
318	510.00	300
319	185.00	90

4. On sundry orders still in process at the close of the month, the labor cost amounted to $750, the direct labor hours were 400, and direct material cost amounted to $800.

5. The predetermined manufacturing overhead amounted to $6,525 and the predetermined direct labor hours 1,500, which was the basis for applying manufacturing overhead to the cost of all orders.

6. The actual manufacturing overhead during the month was $6,945.

Required:

a) Statement of production cost.

b) Journal entries:

(1) Issues of direct materials.
(2) Direct labor.
(3) Applied manufacturing overhead.
(4) Completed production.
(5) Actual manufacturing overhead.

14–2. The Collins Manufacturing Corporation during the month of January produced four orders as follows:

Order No.	Units Produced
151	10
152	5
153	12
154	15

The materials issued for each order were as follows:

Order No.	Amount
151	$30.00
152	25.00
153	40.00
154	35.00

The direct labor charges were as follows:

Department	Order 151	Order 152	Order 153	Order 154
1	$12.00	$13.40	$ 9.50	$13.25
2	–	18.00	14.00	13.50
3	7.00	–	13.40	–
4	–	12.00	–	7.00
5	4.50	6.50	12.00	20.00

The manufacturing overhead rates based on direct labor-hours were as follows:

Department	Rate
1	$1.708
2	1.072
3	.762
4	1.150
5	2.020

The hours spent on the various jobs were as follows:

Department	Order 151	Order 152	Order 153	Order 154
1	8	10	7	9
2	–	14	12	10
3	6	–	10	–
4	–	8	–	6
5	4	5	8	16

Required: Compute the manufacturing cost of each order and the unit cost of each order. *Note:* Compute unit cost to the nearest cent.

14–3. The Nut and Screw Company has a number of factory buildings in various parts of Jersey City. These factories are designated by number, and each carries certain accounting records which are controlled from the main office.

The Factory Ledger of Factory 18 showed the following accounts and balances on April 1, 19—.

Stores	$64,629.82	
Work in Process	16,636.81	
Underapplied Overhead	2,296.40	
Main Office Control		$83,563.03

The factory is divided into three machine groups or departments, and the overhead is applied to the product on an hourly basis. The hourly rates are:

Department A	$1.862
Department B	1.718
Department C	1.911

The manufacturing overheads for the month of April, 19—, are:

Dept. A	Dept. B	Dept. C
$2,900.00	$2,635.00	$3,260.00

The records showed the following, relative to orders in progress on April 1, 19—, direct costs accumulated against each order during the month, and productive hours spent on each order in each department:

Order	Work in Process	Direct Charges During April		Productive Hours Spent During April on Each Order		
No.	April 1, 19—	Material	Labor	Dept. A	Dept. B	Dept. C
1	$ 1,870.28	$ 386.24	$ 461.22	150	200	290
2	1,683.93	248.96	918.23	300	250	270
3	4,737.47	522.84	641.86	290	160	240
4	2,799.83	637.92	922.03	340	300	300
5	3,288.73	428.96	461.04	270	230	220
6	2,256.57	645.21	922.43	150	160	180
7		382.69	761.89	30	100	100
8		1,001.05	1,223.87	70	100	200
	$16,636.81	$4,253.87	$6,312.57	1,600	1,500	1,800

Indirect materials requisitioned during the month amounted to $1,200. Material and supplies received during the month totaled $5,261.92. Orders 1, 2, 3, and 4 were shipped out during the month.

Required: Prepare journal entries of all transactions given and ledger accounts as of April 30, 19—. Also prepare trial balance of the factory ledger and submit a schedule supporting the balance in work in process at April 30, 19—.

14–4. The following information has been derived from the cost records of the Scientific Products Corporation.

Work in Process June 1:

	Material	Labor	Manufacturing Overhead
Job 1004	$1,408.84	$960.00	$1,392.00
1006	565.80	400.00	580.00

Costs charged to jobs during June:

	Material	Labor	Manufacturing Overhead
Job 1004	$ 370.00	$ 556.80	$1,125.00
1006	700.00	295.60	506.00
1007	2,852.00	1,743.00	3,009.42
1008	5,154.12	3,892.80	5,885.10
1009	949.40	796.40	1,047.22
1010	2,061.44	709.60	1,231.78

Jobs 1004, 1006, and 1007 were finished and shipped.
Job 1008 was finished but was not shipped at June 30.
Jobs 1009 and 1010 were incomplete at June 30.

Prepare:

a) Journal entries to record above information.

b) Schedule of balances in Cost of Goods Sold, Finished Goods and Work in Process accounts.

14–5. A company manufacturing items from plastics has a separate section of the tool department devoted entirely to production of molds (or tools) to be used in production of molded parts. In connection with this work it has a drafting section fully occupied in designing these molds.

At present the earnings of draftsmen are charged to tool department overhead and subsequently liquidated by spreading it over jobs done in the tool department on the basis of tool department direct labor. The controller was not satisfied with this method and asked the factory cost supervisor to suggest a better method. The latter proposed that the draftsmen's earnings be included in the tool department direct labor. They would thus be charged to specific jobs and included in the total direct labor cost base upon which tool department overhead was applied.

The controller objected on the ground that drafting could not properly be classified as direct labor because it did not further the physical progress of a mold. He then said that in his opinion the drafting cost should be charged to specific molds on a job order basis, but that it should be treated as a separate item of cost rather than as either overhead or direct labor.

a) Are earnings of draftsmen properly classified as direct labor? Why or why not?

b) What difference will the various methods proposed make in cost of the molds?

c) What method should be used? Why?

14–6. The Waverly Manufacturing Company has decided to change its method of distributing factory overhead to its products which are manufactured on special order. You are asked (*a*) to develop appropriate departmental rates, based on the company's operations for the first half of 19—, and (*b*) to illustrate their use by determining the cost of Job Order 987 by applying the rates you develop.

The trial balance of the company's factory ledger, for the six months ended June 30, 19—, is as follows:

Materials and Manufacturing Supplies	$ 85,321.00
Work in Process—Material	86,105.00
Work in Process—Labor	82,872.00
Work in Process—Manufacturing Overhead	161,480.00
Indirect Labor	41,740.00
Factory Rent	2,400.00
Insurance—Machinery and Equipment	4,216.00
Compensation Insurance	2,486.00
Superintendence	6,000.00
Factory Clerical Salaries	4,950.00

Machinery Maintenance and Repairs	$ 31,010.00	
Depreciation of Machinery and Equipment	42,800.00	
Fuel	3,172.00	
Electricity	2,178.00	
Manufacturing Supplies Used	3,617.00	
Social Security Taxes	9,210.00	
Factory Office Supplies	879.00	
Miscellaneous Factory Overhead	1,212.00	
Manufacturing Overhead Applied		$158,200.00
General Ledger Control		413,448.00
	$571,648.00	$571,648.00

Additional data: The manufacturing operations are carried on in three production departments, A, B, and C, with the aid of two service departments, numbered 1 and 2, respectively. Other data are as follows:

		Departments				
	Total	A	B	C	1	2
Plant floor space (sq. ft.)	30,000	10,000	5,000	2,000	7,500	5,500
Number of employees	109	50	20	4	25	10
Number of labor hours	113,360	52,000	20,800	4,160	26,000	10,400
Number of machine hours	47,952	31,912	9,640	560	5,840	-
Salaries and wages	$ 161,317	$ 76,180	$ 28,472	$ 9,975	$ 37,230	$ 9,460
Cost of machinery and equipment	$1,019,047	$623,225	$250,960	$20,210	$112,862	$11,790
Annual depreciation rates		8%	8%	10%	10%	20%

In developing overhead rates, expenses not distributed in the above table should be distributed to departments as follows:

On the basis of floor space:
Factory rent; fuel; ¼ of electricity

On the basis of salaries and wages:
Compensation insurance
Superintendence
Manufacturing supplies used
Social security taxes
Factory office supplies
Miscellaneous factory overhead

On the basis of investment in machinery and equipment:
Insurance, machinery, and equipment
Machinery maintenance and repairs
¾ of electricity

Factory clerical salaries and $4,500 of indirect labor are charged to Department 2. The balance of indirect labor is charged to Department 1.

Expenses of Department 1 are to be distributed, 1/10 to Department 2, the balance to all other departments on the basis of machine hours.

Expenses of Department 2 are to be distributed to Departments A, B, and C, on the basis of labor hours.

The departmental overhead rates are to be based on machine hours for Departments A and B, and on labor hours for Department C.

Data applicable to Job Order 987 are as follows:

Material, $487.92; direct labor, $465.00.

Machine hours:	Department A,	50 hrs.
	Department B,	12 hrs.
Labor hours:	Department C,	20 hrs.

CHAPTER 15

15–1. The Metal Manufacturing Company has a contract for the manufacture of machine parts A and B for the C. L Corporation, a manufacturer of machinery.

The contract provides that the C. L. Corporation is to pay the Metal Manufacturing Company the cost of the parts which are delivered to the C. L. Corporation's plant, plus profit of $1 on each Part A and profit of $.60 on each Part B, subject to bonus and penalty provisions as follows:

For Parts A there is to be paid a bonus (in addition to the $1 previously mentioned) of 50% of the amount, if any, by which the cost of each part is less than the estimated cost of $9; but the total profit on each part is in no event to exceed $3; and there is to be charged and deducted a penalty (to be applied against the $1 profit) of 50% of the amount, if any, by which the cost of each part exceeds $9, but the total amount of penalty with respect to each part is in no event to exceed the amount of $1.

For each Part B the estimated cost is $6, the maximum total profit on each part is $2 and the maximum penalty on each part is $.60; otherwise the bonus and penalty provisions in connection with Parts B are in accord with those previously stated as applicable to Parts A.

It has been agreed that settlements are to be made on or before the tenth of each month, based on finished parts delivered and the cost thereof for the preceding month stated at the nearest full cent. It has also been agreed that plant overhead is to be distributed in proportion to direct labor and that, in making distributions, decimals are to be extended to four decimal places.

The Metal Manufacturing Company's records show that raw materials as follows are required for the manufacture of parts:

	Part A	Part B
Brass	16 lbs.	14 lbs.
Steel	21 lbs.	17 lbs.

The Metal Manufacturing Company's records show purchases and costs for the month of December, 19—, as follows:

Brass purchased, at $.12 per pound	110,000 lbs.
Steel purchased, at $.05 per pound	30,000 lbs.
Direct labor—Part A	$8,787.48
Direct labor—Part B	6,768.29
Salary of superintendent	500.00
Salaries of foremen	1,400.00
Other indirect labor	1,600.00
Materials and supplies used	4,256.23
Light, heat, and power	4,803.98
Sundry plant expenses	2,741.54
Depreciation	2,959.18

During the month of December, raw materials were put into process as follows:

	Part A	Part B
Brass	49,600 lbs.	70,700 lbs.
Steel	65,100 lbs.	85,850 lbs.

Inventories at the beginning and end of the month were as follows:

December 1, 19—:	
Brass—38,000 lbs. at cost	$4,560.00
Steel—160,000 lbs. at cost	8,000.00
Parts A in process—300 at cost	1,500.00
Parts B in process—200 at cost	600.00
Parts A finished—100 at cost	940.00
Parts B finished—150 at cost	810.00
December 31, 19—:	
Brass—27,700 lbs. at cost	3,324.00
Steel—39,050 lbs. at cost	1,952.50
Parts A in process—500 at cost	2,250.00
Parts B in process—400 at cost	1,400.00
Parts A finished—none	None
Parts B finished—none	None

All parts not otherwise accounted for were delivered to C. L. Corporation during the month of December, 19—.

No scrap or spoiled work is to be considered in connection with this problem.

Required:

a) Summary of parts delivered to C. L. Corporation during December, 19—.

b) Completed ledger accounts for raw materials, parts in process, and finished parts.

15–2. The following problem is based upon the estimate cost system. No factory ledger will be used, all accounts being kept on the general ledger. The business is the making of men's clothes, and two principal materials will be used, fine woolens and plain woolens, of which stock records will be kept. Stock records will be kept for finished goods.

The following styles of clothing will be made, and they are estimated to cost:

	Style 801	Style 802	Style 803
Material	$12.50	$ 8.00	$ 4.00
Supplies (Linings, buttons, etc.)	3.00	2.50	2.00
Labor	9.00	6.00	4.50
Factory overhead, 60%	5.40	3.60	2.70
	$29.90	$20.10	$13.20

Note that the estimated costs are subdivided into four sections, and that the accounts must be kept to record the corresponding divisions of operating costs.

The company starts with the following:

Machinery and equipment	$10,000.00
Cash	40,000.00
Capital stock	50,000.00

The purchases for the first month, according to voucher records are as follows:

Materials—Fine woolens, 2,000 yards at $3.00	$ 6,000.00
Materials—Plain woolens, 3,000 yards at $1.50	4,500.00
Rent of factory	500.00
Lining, buttons, thread, etc.	3,400.00
Salesmen's commissions paid	700.00
Office expenses	120.00
Repairs to machines and equipment	350.00
Electric power	440.00
Oil, waste, and other factory supplies	225.00
	$16,235.00

The payrolls are summarized as follows:

Foreman and timekeepers	$ 250.00
Tailors, cutters, etc. (Direct labor)	4,600.00
Office and salesmen's salaries	750.00
Inspectors and other indirect factory wages	435.00
	$ 6,035.00

Allowance for depreciation on equipment is calculated at 1% per month.

The cutting-room foreman reports materials used on garments in progress:

1,400 yards fine woolens
2,200 yards plain woolens

The tailoring foreman reports the following garments finished and placed in stock:

Style 801	200 pieces
Style 802	300 pieces
Style 803	200 pieces

The sales record is as follows:

Invoice No. 1, Style 801, 100 pieces	$ 4,000.00
Invoice No. 2, Style 801, 50 pieces	2,050.00
Invoice No. 1, Style 803, 100 pieces	2,000.00
Invoice No. 3, Style 802, 100 pieces	3,000.00
Invoice No. 4, Style 802, 100 pieces	2,800.00
Invoice No. 4, Style 803, 25 pieces	450.00
	$14,300.00

Received cash from customers $9,000.

Paid out cash for wages $6,035, and other vouchers $7,650.

Inventories at end of month. (In addition to stock of raw materials and finished goods as shown by stock records.)

Supplies $1,000

Work in Process:

Style 801, 50 pieces:

All material cut.
All supplies provided.
Labor half-completed.

Style 802, 100 pieces:

All material cut.
Half of supplies provided.
Half of labor finished.

Required: Prepare journal entries, cost controlling accounts, profit and loss statement, statement of production cost for the month, and balance sheet. Adjust variances through cost of sales.

15–3. The Taylor Manufacturing Company has a contract to manufacture 10,000 units of product X, a regular-line product, for a lump-sum price. This price was determined on the basis of estimates of manufacturing cost, selling, administrative, and general expenses, and provision for net profit.

The management desires to check manufacturing cost estimates against corresponding actual costs through the factory accounting records, and decides to make use of procedures followed under estimated cost systems in which estimated and actual costs are reflected in opposition in cost accounts and variations are developed thereby. These comparisons are to be made monthly so that differences between estimated and actual costs can be detected and controlled currently.

Product X has been manufactured by two major processes developed in the Fabricating and Finishing Departments. Estimated costs per unit of product for each of these departments follow:

PRODUCT X

ESTIMATED COST PER UNIT

	Fabricating Department			Finishing Department		
	Quantity or Time	Estimated Value	Total	Quantity or Time	Estimated Value	Total
Direct materials	3 units	$1.20	$3.60			
Direct labor	2 hrs.	.90	1.80	1.5 hrs.	$1.00	$1.50
Manufacturing overhead	2 hrs.	.60	1.20	1.5 hrs.	.50	.75
Total			$6.60			$2.25
Total unit cost						$8.85

Product and cost data for operations during the first month under the contract are as follows:

	Fabricating Department		Finishing Department	
Beginning inventory:				
Quantity	200 units		80 units	
Average state of completion	35%		55%	
Costs:				
Direct materials	$720.00			
Transfer materials from Fabricating Department			$528.00	
Direct labor	126.00		66.00	
Manufacturing overhead	84.00	$ 930.00	33.00	$ 627.00
Materials purchased and issued		$9,100.00		
Direct labor incurred		3,810.00		$3,860.00
Manufacturing overhead incurred		3,180.00		2,105.00
Ending inventory:				
Quantity	300 units		240 units	
Average state of completion	60%		70%	

Note.—The amounts in the above tabulation are at actual cost, with the exception of the beginning inventories, which are stated at estimated cost.

During the month, 2,000 units were finished, of which 1,800 units were shipped to the purchaser under the contract. Goods are assumed to be produced and sold on a first-in, first-out basis.

Required: Prepare statements of factory accounts showing quantities, costs, inventory balances, and variances.

15–4. The R Manufacturing Company estimates its cost for a unit of Product X to consist of the following:

Material	5 lbs. at $1.22 per lb.
Labor	7 hrs. at $1.30 per hr.

Overhead is applied on a direct labor basis and need not be considered in this problem.

The company takes the raw materials purchased into Inventory of Raw Materials at $1.22 per pound, recording any difference between that price and actual purchase cost in a Price Variation—Materials account. The actual raw materials used are issued to production at $1.22 per pound. The material cost and the actual direct labor cost for the month are recorded in separate work in process accounts. Finished goods inventory is debited and these process accounts are credited with the estimated cost of completed units. At the end of the month the finished goods account and the work in process accounts are adjusted to actual cost by spreading the differences between actual costs and estimated costs over the accounts in proportion to the amounts of estimated costs applicable to each of the accounts. Material price variation is spread over Inventory of Raw Materials, Work in Process and Finished Goods in the same manner as other variations, but the amount applicable to Inventory of Raw Materials is left in the Variation account.

Account balances after adjustment for March 31, but before adjustment to actual costs for April 30, were as follows:

Account	Debit Balances 3/31 After Adjustment	Debit Balances 4/30 Before Adjustment
Inventory of Raw Materials	$10,485.90	$10,673.78
Price Variation—Material	723.55	973.28
Work in Process—Material	770.80	1,091.90
Work in Process—Labor	731.15	758.94

The March 31, 19— balance of Work in Process—Material includes $49.78 of Price Variation. Status of the work in process was as follows:

	March 31, 19—		April 30, 19—	
	Units	% Completed	Units	% Completed
Material	60	50	50	30
Material	80	90	100	75
Labor	60	25	50	10
Labor	80	80	100	60

During the month of April, 19—, 510 units of Product X were completed and transferred to finished goods.

You are to set up skeleton ledger accounts for all of the accounts affected by these transactions and prepare and post the adjustments necessary for the company as of the end of April, 19—.

15-5.

ABC MANUFACTURING COMPANY

TRIAL BALANCE, DECEMBER 31, 19—

	Debit	Credit
Cash	$ 50,000.00	-
Accounts Receivable	150,000.00	-
Allowances for Discounts	-	$ 9,000.00
Inventory of Raw Materials, January 1, 19—	100,000.00	-
Inventory of Work in Process, January 1, 19—	8,960.00	-

	Debit	Credit
Inventory of Finished Product, January 1, 19—	$ 22,000.00	–
Machinery and Fixtures	60,000.00	–
Allowance for Depreciation	–	$ 15,000.00
Prepaid Expenses	2,000.00	–
Accounts Payable	–	30,000.00
Capital Stock	–	200,000.00
Retained Earnings	–	175,360.00
Sales	–	552,000.00
Discounts and Allowances on Sales	35,000.00	–
Purchases—Raw Materials	194,400.00	–
Labor	113,950.00	–
Manufacturing Overhead	149,900.00	–
Depreciation	3,000.00	–
Selling Expense	48,750.00	–
General Expense	43,400.00	–
	$981,360.00	$981,360.00

The company manufactures a specialty product from a variety of raw materials. It operates an estimating cost system charging Work in Process at actual and crediting it for estimated costs. Based on previous experience, the cost is estimated to be:

Material	$ 8.00
Labor	6.00
Overhead	6.00
Total	$20.00

The company used the above cost of $20 in valuing the opening inventory and fixed the sales price for the year at $30 per unit. No record is available of the quantities put in process or produced but the sales were found to be made up of 18,400 units at $30, or $552,000.

The opening inventory of work in process consisted of 700 units with material cost $5,600, labor cost $1,680, and overhead $1,680; total $8,960.

The opening inventory of finished goods consisted of 1,100 units at the estimated cost of $20 each, or $22,000.

The inventory of work in process at the end of the year is composed of 1,000 units. Each is completed to the extent of one half as to labor and overhead, but contains all the material cost.

The inventory of the finished product at the end of the year is 1,700 units.

The inventory of raw materials at the end of the year is $80,000.

Variances are distributed to inventories of work in process, finished goods, and to cost of sales on the basis of equivalent units in each of these accounts.

Required:

a) Show the ledger accounts for Work in Process, Finished Goods, Cost of Sales in analytical form. *Note:* Ledger accounts should have columns for Date, Description, Quantities, Material, Labor, Overhead, and Totals, both on debit and credit sides.

b) Prepare the profit and loss statement supported by a cost of production schedule in analytical form showing quantities and cost by elements.

c) Prepare a balance sheet showing inventories at actual cost. *Note:* Round off unit cost calculations in the fourth decimal place. Express closing inventories and cost of sales to the nearest dollar.

CHAPTER 16

No problems have been supplied for this chapter. Problems covering the different aspects of standard costs appear in Chapters 17 through 20.

CHAPTER 17

17–1. The K Manufacturing Co. is establishing standard costs and has assembled the following data covering manufacturing overhead in Department 102 during the preceding year.

Month	Direct Labor Hours	Supplies	Supervision *	Indirect Labor	Repairs	Depreciation
1	600	$380.00	$ 900.00	$1,800.00	$150.00	$1,000.00
2	750	480.00	900.00	2,250.00	175.00	1,000.00
3	800	530.00	900.00	2,100.00	20.00	1,000.00
4	900	570.00	1,220.00	2,500.00	50.00	1,000.00
5	850	580.00	1,188.00	2,400.00	100.00	1,000.00
6	950	630.00	1,236.00	2,500.00	75.00	1,000.00
7	830	590.00	900.00	2,450.00	50.00	1,000.00
8	700	500.00	900.00	2,100.00	150.00	1,000.00
9	650	410.00	900.00	2,100.00	100.00	1,000.00
10	400	300.00	500.00	1,400.00	400.00	1,000.00
11	350	250.00	500.00	1,200.00	700.00	1,000.00
12	550	350.00	500.00	1,700.00	200.00	1,000.00

* Hours	Number of Supervisors	Supervisors' Salaries
0–500	1	$500.00
500–800	2	900.00
Above 800	3	An experienced hourly operator is assigned duties as assistant supervisor at a rate of $2 per hour.

There are 20 working days of 8 hrs. each in the month.

Required:

a) Plot figures for each expense on a scatter chart.

b) Draw a line on each scatter chart to represent the proper budget allowance at the various volumes.

c) Determine the flexible standard cost for each expense.

d) Determine the standard overhead rate for Department 102 assuming standard volume to be 800 direct labor hours per month.

17–2. In setting overhead cost standards, the following data have been prepared for Department 12:

	400 Standard Direct Labor Hours	1,600 Standard Direct Labor Hours	2,400 Standard Direct Labor Hours
Supervision	$ 500.00	$ 650.00	$ 750.00
Allowance for depreciation	2,000.00	2,000.00	2,000.00
Supplies	100.00	175.00	225.00
Power	1,350.00	2,025.00	2,475.00
Indirect labor	250.00	400.00	500.00
Machinery maintenance	240.00	360.00	440.00
	$4,440.00	$5,610.00	$6,390.00

Required:

a) Determine the flexible standard cost for each of the above listed items using the expense data given.

b) Determine the standard overhead rate for Department 12, assuming standard capacity volume to be 2,000 direct labor hours per month. In establishing the rate, show the fixed and variable components as well as the total.

c) Assuming that Department 12 worked 1,700 direct labor hours, that standard direct labor hours in product were 1,600, and that the following actual expenses were recorded for the month of September, prepare a report in form suitable for presentation to the foreman of Department 12.

	Actual Costs for Month of September
Supervision	$ 675.00
Depreciation	2,000.00
Supplies	175.00
Power	2,080.00
Indirect labor	440.00
Machinery maintenance	370.00
Total	$5,740.00

17–3. The Metal Products Company operates a plant at which is produced a standardized line of small metal articles that do not differ very much in type, cost, or sales value.

It has been decided to include overhead in the production cost at departmental standard rates, and you are called in to calculate these rates from the following annual operating data prepared by the company:

PRODUCTIVE CAPACITY OF MANUFACTURING DEPARTMENTS

	Machine Hours	Direct Labor Hours	Direct Labor Dollars
Machining A	50,000	100,000	$80,000.00
Machining B	40,000	40,000	30,000.00
Bench assembly	.....	60,000	27,000.00
Packing	.....	50,000	25,000.00

MISCELLANEOUS OPERATING DATA

	Occupied Area (sq. ft.)	Book Value— Machinery and Equipment	No. of Employees	Horsepower	
				In-stalled	Usage Factor
Machining A	18,000	$ 75,000.00	60	125	80
Machining B	15,000	60,000.00	24	80	80
Bench assembly	20,000	12,000.00	36	.	..
Packing	10,000	18,000.00	30	10	50
Maintenance	4,000	9,000.00	..	5	40
Receiving and stores	13,000	8,000.00	..	5	60
General plant	2,000	4,000.00	..		..
Warehousing and shipping	18,000	14,000.00	..	15	60
	100,000	$200,000.00	150	240	

INDIRECT LABOR, MATERIALS, AND SUPPLIES

	Supervision and Indirect Labor	Supplies and Sundry Expenses	Maintenance	
			Materials	Labor *
Machining A	$15,000.00	$18,000.00	$ 8,000.00	$ 9,000.00
Machining B	8,000.00	12,000.00	5,000.00	4,000.00
Bench assembly	7,200.00	2,000.00	500.00	1,000.00
Packing	6,000.00	3,000.00	800.00	600.00
Maintenance	8,000.00	5,000.00	1,000.00	500.00
Receiving and stores	4,000.00	1,800.00	300.00	200.00
General plant	16,000.00	8,000.00	500.00	300.00
Warehousing and shipping	10,000.00	8,500.00	1,500.00	1,000.00
	$74,200.00	$58,300.00	$17,600.00	$16,600.00

* Maintenance labor is charged directly to the various departments from maintenance department time tickets.

OTHER EXPENDITURES AND CHARGES

Unemployment tax at the rate of 3%	
F.I.C.A. tax at the rate of 1½%	
Workmen's compensation—per $100 payroll:	
Machining departments	$ 2.50
General plant department	.75
Other departments	1.50
Purchased power	18,000.00
Rent, light, and heat	30,000.00
Insurance and sundry taxes	2,400.00
Depreciation at 10% per annum	20,000.00

The Receiving and Stores Department receives and stores the sheet metals, all of which enter into the manufacturing processes through Machining Department A. There is not much difference in the costs of the several kinds of metal used, and in the time to machine them, for the various products do not vary greatly.

The General Plant Department consists of the superintendent's and the paymaster's offices.

The Warehousing and Shipping Department stores and ships the manufactured product only.

All direct labor is paid at hourly rates. All employees work about the same number of hours per annum. They earn less than $3,000 per annum, except the superintendent and the foreman of Machinery Department A who receive $8,000 and $5,000 per annum, respectively.

From the foregoing information prepare a comprehensive summary of the standard annual overhead, leading to and showing the departmental overhead rates. State the basis or bases on which the overhead should be applied to the direct manufacturing costs.

17–4. You have been retained by the Standard Extruding Company to install a standard cost system. A preliminary investigation shows that the company has an excellent financial accounting system. However, no cost system is in use, the only cost information available being memorandum estimates of insufficient precision to be of any real value. There are six departments, all in the plastics field. Of these, you select the extruding department for your first experiment in standardization because:

1. It is the largest single department.
2. The development stage is over and the rate of change in efficiency has tapered off.
3. No drastic changes in layout, equipment, or type of product are anticipated in the near future.

This department compounds and extrudes three different kinds of electrical insulating tubing: Alpha, Beta, and Gamma, each in five standard sizes and numerous special sizes to order, and each size in seven standard colors. Batch sizes show wide variation. Production is for order only. Alpha and Beta are the two major products.

A physical inspection of the department reveals that there are two basically different types of operations being performed:

1. Compounding, which includes mixing, milling, and grinding of the materials to be extruded.
2. Extruding, which is the extrusion, inspection, and preliminary packing of the extruded plastic tubing.

The dollar costs involved are sufficient to warrant two cost centers: Compounding and Extruding. For the compounding cost center you arrive at the following standard costs per pound for 1953 for the compounded material: Alpha $.50, Beta $.60, and Gamma $.70. These figures include labor and overhead at the standard rate of $1.00 per standard man-hour.

Getting Physical Information. The records now in use are entirely inadequate for your purpose. You thus find it impossible to use any data accumulated up to this time and must start to accumulate accurate physical information at this point.

TEST RUNS

SCHEDULE 1

Size 1		Size 2		Size 3		Size 4		Size 5	
Machine Hours	Good Production (in feet)	Machine Hours	Good Production (in feet)	Machine Hours	Good Production (in feet)	Machine Hours	Good Production (in feet)	Machine Hours	Good Production (in feet)
100	100,000	200	100,000	450	150,000	800	200,000	1,000	200,000
165	150,000	270	150,000	1,160	400,000	1,170	300,000	510	100,000
61	50,000	400	100,000	165	50,000	820	200,000	490	100,000
190	200,000	205	50,000	320	100,000	1,560	400,000	200	400,000
110	100,000	410	200,000	310	200,000	1,000	100,000	250	50,000
55	50,000	810	400,000	1,400	500,000	810	200,000	1,005	200,000
20	50,000	100	50,000	630	200,000	195	50,000	995	200,000
100	50,000	390	200,000	310	100,000	408	100,000		
210	200,000	198	100,000	140	50,000	1,640	400,000		
225	250,000	100	50,000	1,510	500,000	810	200,000		
190	200,000	790	400,000			200	50,000		
195	200,000	210	100,000			1,600	400,000		
100	100,000	395	200,000						
205	200,000	405	200,000						
		193	100,000						
		100	50,000						
1,926	1,900,000	5,176	2,450,000	6,395	2,250,000	11;013	2,600,000	4,450	1,250,000

Two operators are always required on a machine except for a short setup period, which requires only one. It thus makes no appreciable difference whether man hours or machine hours are used. Since production and sales are accustomed to machine hours, you select a machine hour basis. You also wish to get man hours as a check.

The machines are of three different sizes and differ within each size group, but the differences in cost of operation are not great enough to warrant separate rates for different machines. You accordingly instruct the timekeepers to keep a batch record on a job order basis containing physical information only. You then check their results and accumulate the necessary information on analysis sheets.

Setting Physical Standards. Graphic analysis has convinced you that color has no effect on cost. For the purpose of this problem you may assume that the effect of batch size is negligible. For the last six months of 1952, your accumulated information for product Alpha in condensed form is shown in Schedule 1 (page 667).

Required: a) For each batch listed, prepare a schedule by sizes showing the machine hours per 100 ft. of good production for each run in each size. For each size listed, compute the arithmetic average, the arithmetic average excluding doubtful observations, and the median machine hours per 100 ft. Set the standard production per machine hour for each of the five sizes, using the medians.

By use of the same method, the standards obtained for Beta are:

Size	Standard Machine Hrs. per 100 Ft.
1	.11
2	.22
3	.33
4	.44
5	.55

Data available are insufficient to standardize Gamma at this point, and it must be left on an actual basis. The standards are now reported to the management.

Comparison of Standard and Actual (Physical). For the month of January, 1953, the results of operations are available and are shown in Schedule 2.

ACTUAL PRODUCTION FOR JANUARY 1953

Schedule 2

	Product	Good Production (ft.)	Actual Machine Hours
Alpha	Size 1	400,000	350
	Size 2	500,000	1,200
	Size 3	400,000	1,200
	Size 4	600,000	2,500
	Size 5	100,000	400

	Product	Good Production (ft.)	Actual Machine Hours
Beta	Size 1	200,000	200
	Size 2	250,000	300
	Size 3	200,000	700
	Size 4	300,000	1,300
	Size 5	50,000	300
Gamma	All Sizes	500,000	1,000
		3,500,000	9,450

Required: b) Prepare a report showing the good production, actual machine hours, standard machine hours, and variance over or under standard for each size of each standard product produced and for the total volume of production in this cost center.

(This problem is continued in the next chapter.)

CHAPTER 18

18–1. Refer to Problem 17–2.

Required:

a) Prepare an analysis of the total variance, showing the portions due to volume, efficiency, and spending.
b) Prepare journal entries to record costs of Department 12 for the month.

18–2. The Beverly Company manufactures product M. The fabrication of this product takes place on three successive and continuous operations: M-10, M-11, and M-12. These three operations constitute one process. The manufacturing costs for labor and overhead in each operation are represented by the following percentages:

PERCENTAGES OF COST OF MANUFACTURE OF UNIT M

Operation	Labor	Overhead
M-10	20%	40%
M-11	35	40
M-12	45	20
Total	100%	100%

The company does not record the actual labor and overhead charges applicable to each operation. The percentages are used to allocate costs to inventories in process which vary with the stage of completion shown by the above tabulation.

The Beverly Co. operates a cost accounting system based on standard costs which are incorporated in the manufacturing cost accounts. The differences between standard costs and actual costs are reflected in appropriate variance accounts, namely, material price, material usage, direct labor rate, direct labor time, and over-all manufacturing overhead. The material price variance is assumed to be realized at the time of purchase.

The standard manufacturing costs used for unit M (based on a planned monthly production ranging between 8,000 and 12,000 units M) are as follows:

	Per Unit M	
	Quantity or Hours	Amount
Material:		
Item M-a (issued in operation M-10)	1	$ .50
Item M-b (issued in operation M-12)	1	2.00
Direct labor (total for all operations at uniform rate of $5 per hour)	¼ hr.	1.25
Overhead (applicable to operations as a whole)		1.50
		$5.25

The inventories applicable to unit M as at December 31, 19—, stated in accordance with the foregoing schedule of standard costs, are as follows:

Material—Item M-a—100 units; item M-b—100 units
Work in progress—50 units complete through operation M-10
Finished goods—none

Transactions during the following January are as follows:

The voucher register reflects applicable transactions paid and incurred as follows:

	Amount
Material purchases—	
Item M-a—12,000 units at $ .45 per unit	$ 5,400.00
Item M-b—12,000 units at 2.10 per unit	25,200.00
Payroll for all operations—	
Direct labor—3,100 hours at $1.2625 per ¼ hr.	15,655.00
Indirect labor	1,500.00
Manufacturing overhead, other than indirect labor	15,000.00
Selling, administrative, and general expenses	25,000.00

Other facts are:

During January, 19—, 11,000 units M were transferred to the finished goods warehouse and 10,500 units were sold at $9 per unit M.

As at January 31, 19—, 100 units of work in progress are complete through operation M-11.

Stores requisitions indicate issuances of material items M-a and M-b in the quantities required for the production carried through the respective operations. A supplementary stores requisition, however, indicates that item M-a actually used was 2% in excess of standard quantity required.

Required:

a) Journal entries for January, 19—, transactions.
b) Profit and loss statement for January, 19—. Variances are to be shown as adjustments to gross profit.

c) Show how the values of work in process at beginning and end of the period are arrived at.

(*Adapted from an American Institute of Accountants examination*)

18–3. The Lee Roberts Manufacturing Company used a standard cost system in accounting for the cost of its single product. Their standard was set as follows:

Standard output per month—10,000 units.
Standard direct labor per unit—8 hrs. at $1.30 per hour.
Standard direct material per unit:
  Material P—10 lbs. at $.275 per pound.
  Material Q—5 units at $.64 per unit.

Total standard cost per unit including overhead on a direct labor hour basis—$23.55.

The following operating data were taken from the records for the month of March, 1950:

In process first of month—none.
Completed during month—8,000 units.
In process end of month—1,000 units, which are one-half complete as to labor and have had all of material P issued for them and sufficient material Q for one-half of them.
Direct labor was $88,440 which was at a rate of $1.32 per hour.
Material issued to production:
  94,000 lbs. of P; purchased at $.26 per pound.
  42,600 units of Q; purchased at $.65 per unit.
Overhead for the month amounted to $61,640, of which $40,000 represents fixed overhead, balance variable.

You are to prepare a schedule showing the variance of actual cost from standard cost and an analysis of variances for labor, material, and overhead, separating each into the factors which caused them. Show all computations supporting your schedule.

(*Adapted from an American Institute of Accountants examination*)

18–4. The following problem is a continuation of Problem 17–4.

GETTING FINANCIAL INFORMATION. By the use of the usual methods, allocate manufacturing overhead items as shown on the general books to extruding cost center by accounts for the last six months of 1952. These figures are used as a basis for setting cost standards to be used in 1953. The results for the last six months of 1952 are tabulated with the financial figures in Schedule 3.

Most scrap in extruding results from setup in the extruding process and it is all assumed chargeable against extruding. Include remilling cost incurred in compounding in the extruding overhead.

SCHEDULE 3

EXTRUSION DEPARTMENT
PHYSICAL PRODUCTION AND COSTS

JULY THROUGH DECEMBER, 1952

1952	Production Volume Std. Machine Hours	Direct Labor	Indirect Labor	Power, Supplies, and Maintenance	Other Service Departments	Deprec., General Expenses	Other Expenses	Remilling
July	7,000	$ 7,100.00	$2,600.00	$1,900.00	$1,000.00	$ 960.00	$510.00	$1,400
August	9,000	9,000.00	3,200.00	2,300.00	950.00	1,000.00	500.00	1,800
September	8,000	8,000.00	2,900.00	2,100.00	1,050.00	1,000.00	490.00	1,600
October	12,000	11,900.00	4,100.00	2,900.00	1,000.00	1,040.00	520.00	2,400
November	15,000	15,050.00	5,000.00	3,500.00	980.00	970.00	480.00	3,000
December	9,000	8,950.00	3,200.00	2,300.00	1,020.00	1,030.00	500.00	1,800

You are advised that no change in the level of expense is expected for 1953, except that *an increase of 5%* will be given direct labor on January 1, 1953, also that the volume of production for 1953 is expected to be the same as the average for the last six months of 1952.

Required:

a) Plot each of the overhead items shown above for the six-month period (including remilling charge) against the volume of production. Prepare the flexible budget for the extruding cost center, assuming that direct labor may be included with manufacturing overhead. Assume also that the fixed component is $500 for each of the semivariable expense classifications.

b) Present your flexible budget in statement form. Determine the standard labor and burden rate for use in 1953. These results are then reported to the management.

(This problem is continued in the next chapter.)

CHAPTER 19

19–1. The following data are available for Department 12:

	Standard Machine Hours per Month	
Manufacturing Overhead	2000 Hrs.	4000 Hrs.
Materials Handling	$1,200.00	$2,400.00
Inspection	300.00	500.00
Power	700.00	1,200.00
	$2,200.00	$4,100.00

Standard overhead rate per hour, $1.025.

Production during October contained 4100 standard hours and actual running time was 4300 hours. Actual expenses were: Materials Handling $2,580; Inspection $500; Power $1,280.

Required:

a) Prepare a cost comparison sheet in a form appropriate for the foreman of Department 12. Include in the report a column showing the standard amount of fixed expense and the standard rate per hour for the variable component of each expense.

b) Draft journal entries to record overhead transactions for the month. Accompany each entry with a brief explanation of the purpose of the entry and show how the figures were obtained.

19–2. The AB Company keeps inventory accounts, including raw materials, at standard cost. It uses a raw material here called M, to make a product called P. M has a standard cost of $1.00 per unit and the standard usage is one unit of M to make ten units of P. Price variance is obtained at time of purchase. Following are the transactions which occurred during November:

1. Purchases of M:

500 units at $1.75	$ 875.00
1,000 units at 1.40	1,400.00
500 units at 1.45	725.00
2,000	$3,000.00

2. Production order calling for 5,000 units of P is released. Since the goods are for stock, an over- or under-run is permissible. A requisition for 600 units of M accompanied the order and the materials were issued.

3. The overissue of materials was discovered and 100 units of M were returned to stores.

4. Production records show: 4,000 units of P finished and transferred to finished goods stock; 300 units of P rejected on inspection. Rejected units have no value.

5. Physical inventories at the end of the month: 60 units of M in process. Materials not otherwise accounted for have been lost in processing operations. 2000 units of P in finished stock. Goods not on hand have been sold.

Required: Prepare journal entries to record the above transactions. Accompany each entry with a brief explanation stating the purpose of the entry and how figures were obtained where these must be calculated.

19–3. The X Company has a service department which repairs electrical equipment in productive departments. The latter are charged $.40 per machine hour for the service. This rate was determined by dividing total machine hours for all productive departments at normal volume into the expenses budgeted for the service department. At the end of December, the foreman of Productive Department 5 finds that he is charged with the following cost for electrical repair service:

Standard cost	$800	(2,000 standard hours produced at $.40)
Actual cost	880	(2,200 actual hours run at $.40)
Variance loss	$ 80	

The foreman objects on grounds that he actually used less service than in a previous month when the variance was favorable and that the rate of $.40 per hour is too high because the service department's employees are inefficient. You have been asked to review the company's cost control procedures for the purpose of improving them. What recommendations would you make?

19–4. The standard cost of product K is:

Material—5 units at $1.00	$ 5.00
Labor—10 hrs. at $1.50	15.00
Overhead—200% direct labor	30.00
	$50.00

In December the company purchased materials at the following prices:

25 units at $ .80	$ 20.00
25 units at 1.05	26.25
50 units at 1.10	55.00
	$101.25

Price variance is obtained at time of vouchering. During the same month 60 units of material were used in manufacturing and 10 units of product K were produced.

Direct labor is paid a base rate of $1.25 per hour worked plus an incentive rate of $.25 per standard hour produced. During December actual hours worked were 110.

Flexible standard overhead costs for the company in question are:

Supervision	$ 30 fixed plus 40	% of direct labor dollars
Indirect labor	20 fixed plus 60	% of direct labor dollars
Supplies	0 fixed plus 33⅓	% of direct labor dollars
Depreciation	100 fixed plus 0	% of direct labor dollars

Actual overhead costs for the month are: supervision $90; indirect labor $100; supplies $30; depreciation $100.

Required: Prepare journal entries to record material, labor, and overhead, showing calculation of figures in explanations. Use two-variance system for analyzing overhead.

19–5. The following problem is a continuation of Problem 18–4.

COMPARISON OF STANDARD AND ACTUAL (FINANCIAL). Financial results of operations in the extruding cost center in January, 1953, were as follows:

Direct labor	$11,000.00
Indirect labor	3,700.00
Power, supplies, maintenance	2,600.00
Other service departments	1,050.00
Depreciation and general expense	920.00
Other expenses	495.00
Remilling charge	2,000.00

Required:

a) Prepare a variance report for the extruding cost center for January, 1953 by individual accounts as well as totals.

PREPARATION OF STANDARD PRODUCT COSTS. The following raw material standards, not hitherto referred to have been established for the extrusion of Alpha:

Size	R.M. per 100 Ft.
1	.5
2	.7
3	1.0
4	1.5
5	2.0

Required:

b) Prepare a list of standard product costs for the five standard sizes of Alpha, showing standard raw material cost, standard labor and overhead, and total standard manufacturing cost. These results, together with the standard product costs for the other standardized products, are then reported to the management.

19–6. The Hussell & Bussell Company, Inc. uses a standard cost system. It manufactures Dolomite for which standard costs per square yard have been set as follows:

Direct Materials (issued at beginning of process)—5 lbs. at $.30	$1.50
Direct Labor—¾ hour at $1.40 per hour	1.05
Overhead—¾ hour at $1.80 per hour	1.35
Total cost of Dolomite per square yard	$3.90

The monthly standard capacity of the plant is 9,600 hrs. and 12,800 sq. yds. The flexible overhead budget at standard is $17,280 and at 85% is $15,840.

Inventories on August 1, 19— were:	Standard	Actual
Materials—4,000 lbs.	$1,200.00	$1,160.00
Work in Process (66⅔% completed)—750 sq. yds.		
Materials in Process	1,125.00	1,087.50
Direct Labor in Process	525.00	537.00
Overhead in Process	675.00	683.00
Finished Goods—1,000 sq. yds.	3,900.00	3,886.00

During August, the Company purchased 75,000 lbs. of direct materials at $.29½ a pound; issued 59,100 lbs. of material for 11,600 sq. yds.; incurred direct labor costs (8,510 hrs. at $1.42) $12,084.20; and indirect labor $2,150; incurred actual manufacturing overhead, including indirect labor, $15,450; finished 11,750 sq. yds.; sold 11,000 sq. yds. for $5.50 each; and on August 31 had 600 sq. yds. in Work in Process averaging 45% completed.

Required:

a) Submit the journal entries for August transactions. (Use separate work in process account for each cost element.)

b) Prepare variance analyses for material, labor, and manufacturing overhead. *Note:* Overhead variances are to be analyzed according to

(1) Two-variance method

(2) Three-variance method

c) Cost of production statement.

CHAPTER 20

20–1. The Lovejoy Manufacturing Company operates a measurement standard cost system. Its budgeted production for the three-month period ended March 31, 19—, is 3,100 units. Measurement standards per unit are as follows:

Material—8 lbs. at $.75 per lb.	$ 6.00
Labor—4 hrs. at $2.00 per hr.	8.00
Overhead—4 hrs. at $1.20 per hr.	4.80
	$18.80

Note: The overhead rate consists of fixed charges $.70 and variable charges of $.50 per hr.; standard capacity is 3,000 units.

The following transactions took place:

1. Material purchases
   15,000 lbs. at $.80 per lb.
   17,000 lbs. at $.85 per lb.
2. Materials returned to suppliers
   500 lbs. at $.80 per lb.
3. Material withdrawn from storeroom 24,800 lbs.
4. Actual material consumption 24,500 lbs.; excess returned to stores.
5. Actual direct labor 12,500 hrs. at $1.95 per hour.
6. Actual manufacturing overhead $13,500.
7. Production 3100 units; no opening or closing work in process inventories.
8. Sale of 2500 units at $25 per unit.

Required:

a) Journal entries and ledger accounts.
b) Trial balance March 31, 19—.
c) Gross profit statement for three months ended March 31, 19—.
d) Statement of variances.

Note: Ratios are to be computed to the nearest percentage point, dollar amounts to the nearest dollar. Use a single work in process account.

20–2. The following information was taken from the books of a manufacturing company:

A. Budget Figures

Standard Plant Capacity—10,000 hrs. = 20,000 units

Production Budget at standard capacity:

Material—100,000 yds. at $.10	$10,000.00	
Labor—10,000 hrs. at $.60	6,000.00	
Manufacturing Overhead—10,000 hrs. at $.40	4,000.00	
		$20,000.00

B. Flexible Manufacturing Overhead Budget

	80%	90%	100%	Rate
Variable	$2,000.00	$2,250.00	$2,500.00	$.25
Fixed	1,500.00	1,500.00	1,500.00	.15
	$3,500.00	$3,750.00	$4,000.00	$.40

C. Standard Cost Card

	Standard Costs per Unit
Material—5 yds. at $.10	$ .50
Labor—½ hr. at $.60	.30
Manufacturing Overhead—½ hr. at $.40	.20
	$1.00

D. Opening Balances

	Standard	Actual
Raw Material—5,000 yds.	$500.00	$513.00
Work in Process—200 units		
Material (all issued)—1,000 yds.	100.00	103.00
Labor (½ completed)—50 hrs.	30.00	32.00
Manufacturing Overhead (½ incurred)—50 hrs.	20.00	21.00
Finished Goods—400 units	400.00	375.00

E. Statement of Transactions

1. Purchases 100,000 yds. of raw material at $.105 a yd.
2. Issued the required material for 17,800 units.
3. Issued excess material, 1,000 yds.
4. Payroll for the period:

Direct labor—8,700 hrs. at $.65	$5,655.00
Indirect labor	1,000.00
	$6,655.00

5. Actual manufacturing overhead (including indirect labor) $3,800.00.
6. Finished 17,500 units.
7. Sold 17,000 units at $1.50.

Note: For ending work in process inventories, all material is issued, labor and manufacturing overhead are half completed.

The purchasing price variance is computed at the time of vouchering under current standards only. *Note:* Compute all amounts to nearest dollar; all ratios to nearest percentage point.

Required:

a) The effective production for materials, labor, and overhead.
b) Journal entries for current and measurement standards. Show all computations.
c) Ledger accounts for current and measurement standards.
d) Comparative profit and loss statement for current and measurement standards.

CHAPTER 21

21–1. In the production of a main product and its one by-product a manufacturer utilizes six production departments. Raw material, when placed in process, passes first through the reduction department in which it is fused to a clinker mass. Then it passes to the grinding department and next to the mixing department. From the mixing department it passes to the extraction department at which point the by-product emerges. Both products next pass to the finishing department and to the packing department.

Raw material, when placed in process, is composed of two items, as follows:

X 45% at $110 per ton
Y 55% at 70 per ton

On the above materials, storage and handling cost is computed at 8% of material cost. For each ton put into process in the mixing department, a total of 1 ton of chemicals is added as follows:

A 25% at $ 40 per ton
B 60% at 80 per ton
C 15% at 160 per ton

Direct labor cost is computed on tonnage handled in each department.

Direct department expense and indirect department expense are computed as a percentage of direct labor cost.

The following are the direct labor costs and expense percentages:

Department	Direct Labor per Ton	Direct Department Expense	Indirect Department Expense
Reducing	$20	40%	30%
Grinding	22	150	30
Mixing	30	250	30
Extracting	24	200	30
Finishing	50	60	30
Packing	36	40	30

In the extraction process, 80% of material placed in process becomes main product. Of the remaining portion which is sent to the finishing department along with the main product, two thirds thereof comes out as completed product. There is no loss in finishing main product.

It takes approximately twice as long to finish by-product as it does main product.

By-product is sold at a net profit at $96 a ton, after giving consideration to its share of factory costs. No commercial expenses are assigned to by-product.

Main product is sold for $900 per ton. Main product is charged with commercial expense at the rate of 15% of sales price.

Required:

a) Process cost sheet.
b) Determine the profit per ton of main product sales.

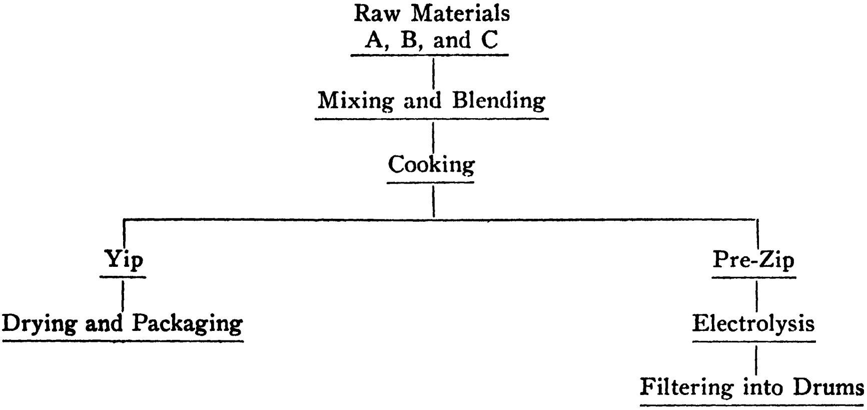
(*Adapted from a New York State C.P.A. problem*)

21–2. Chemco, Inc. has perfected a process for producing from three raw materials A, B and C two chemical compounds, Yip and Zip.

The raw materials are required in the following proportions by weight:

A	3 parts
B	5 parts
C	2 parts
	10 parts

The following diagram illustrates the manufacturing process:



One hundred thousand (100,000) pounds of raw material will be processed. The unit costs of the three raw materials are as follows:

A	$ 2.00 per pound
B	50.00 per ton
C	4.00 per gallon

Other costs of production are estimated to be:

Mixing, blending and cooking	$16,090
Additional costs applicable to Yip:	
Drying and packaging	4,660
Additional costs applicable to Zip:	
Electrolysis and filtering into drums	6,920

The cooking process reduces the weight of the combined raw materials by 40%.

Out of 100,000 pounds of original raw materials, 20,000 pounds of pre-Zip are obtained. Of the pre-Zip electrolyzed 25% becomes a nonmarketable precipitate, the remainder, a liquid, being filtered into 50-gallon drums without further attention.

The cost of drums, which are returnable and for which customers are to be charged specifically, is not to be included in either the cost or the price of Zip.

Each product is to be sold on the basis of a list price, less 35% and 10%. Of the net selling price of each product, 25% is to be allowed for selling, administrative and general expenses (including provision for income tax), and 20% for net profit after provision for all costs and expenses.

The company has never marketed either of the products, but has demonstrated the existence of markets for both if they can be manufactured to sell at suitable prices. Its experience in producing both these and other chemicals leads it to believe that the above estimates of cost relative to the processing of 100,000 lbs. of the three raw materials combined are reliable as a basis for setting a price for each of the products to be manufactured therefrom.

Note: One gallon of Zip weighs 7.5 lbs. One gallon of Raw Material C weighs 8 lbs.

Required: From the information above, prepare the following statements, supported by whatever explanatory schedules you consider necessary:

a) Statement to show at what list price and at what net price per pound Yip should be sold.

b) Statement to show at what list price and at what net price per gallon Zip should be sold.

c) Condensed income statement to show, separately and combined, the results of operations in Yip and Zip, on the assumption that the entire quantity of each product manufactured will be sold at the respective prices indicated in the statements prepared in (*a*) and (*b*), above, and that selling, administrative, and general expenses are to be included at the same estimate as is allowed in setting such prices.

(Adapted from an American Institute of Accountants examination)

21–3. The HKH Oxygen Company operates two producing units—an electrolytic unit and a liquefaction unit, each of which, when operating, produces at capacity.

1. ELECTROLYTIC UNIT. The electrolytic unit produces one volume of oxygen and two volumes of hydrogen simultaneously and this production ratio is maintained throughout, whenever the unit operates. The unit consists of a number of metal tanks, or "cells," containing electrodes carrying low-voltage, high-amperage electrical current.

Water is a compound of oxygen and hydrogen. The positive electrical terminal in each cell attracts oxygen, the negative terminal attracts hydrogen. They bubble off as gases and are collected commercially pure at the rate of 800 cu. ft. of oxygen and 1,600 cu. ft. of hydrogen per hour. Distilled water is continuously added to the cells.

The operating record of the unit for the year was:

7,100 hrs. producing both gases
500 hrs. producing hydrogen only, all oxygen escaping because empty cylinders were not available
400 hrs. producing oxygen only, all hydrogen escaping for the same reason
760 hrs. idle, repair, etc.
8,760 hrs., being 365 days of 24 hrs.

The entire cost of operating the electrolytic unit during the year was $48,000 which includes depreciation. Since the above production ratio of 1 to 2 is constant, this cost is to be apportioned between the two gases on the basis of volume actually produced by the unit. The production cost value of the gases lost is to be treated as a deduction from the gross profit on sales.

2. LIQUEFACTION UNIT. The liquefaction unit separates atmospheric air (containing 20% oxygen and 80% nitrogen) by mechanical means. Air is compressed and expanded and the temperature lowered to about 300° F. below zero, which liquefies the air. The unit produces liquid air at a uniform rate.

Oxygen and nitrogen boil (leave the liquid air as gases) at different temperatures, and one or the other (but not both together) is collected commercially pure. The operating record of the unit during the year was:

Oxygen—7,200 hrs. at the rate of 1,000 cu. ft. per hour
Nitrogen—1,200 hrs. at the rate of 1,333⅓ cu. ft. per hour

The operating cost of the liquefaction unit, including depreciation, aggregated $30,240 for the year. Because of the uniform rate of production this cost is to be apportioned between the two gases on the basis of the number of hours operating.

3. COMPRESSING AND FILLING. The gases are filled into steel cylinders, each of which is always used for the same gas. They are all of the same capacity (except the oxygen 110's) and they are filled at a uniform pressure by three very similar compressors, each compressing only one gas. However, the gases differ in compressibility and the cylinder contents are shown below.

The cost of compression was $13,480 for the year including depreciation of the compressors and the cost is to be allocated to the gases produced on the basis of cubic feet compressed.

The cost of filling, that is, connecting and disconnecting cylinders at the charging line, amounted to $5,643 and is the same for each cylinder, large or small. During the year 6,000 small oxygen cylinders were filled.

4. CYLINDERS. Each cylinder is always refilled with the same gas. They are always returned when empty and no charge is made for their use. The following data are given concerning the number of cylinders owned (all in service) and their depreciation:

	Contents Cu. Ft.	Number Owned	Depreciation	
			Rate	Amount
Hydrogen	190	5,120	$2.09	$10,700.80
Oxygen	220	10,260	2.09	21,443.40
Oxygen	110	1,508	1.32	1,990.56
Nitrogen	200	1,662	2.09	3,473.58

5. OTHER DATA. At the beginning of the year there were on hand 310 full nitrogen cylinders of which the contents of 62,000 cu. ft. were carried forward at the previous year's cost of $.424 per 100 cu. ft. or $262.88. All other cylinders were on hand empty.

At the end of the year 200 full small oxygen cylinders were on hand; their contents, 22,000 cu. ft., are carried forward at the average year's cost. All other cylinders were on hand empty.

All gases are valued for inventory purposes at average cost before charging depreciation of cylinders.

The average sales prices of the gases were as follows:

Hydrogen (in large cylinders) $.80 per 100 cu. ft.
Oxygen (in large cylinders) $1.00 per 100 cu. ft.
Oxygen (in small cylinders) $1.20 per 100 cu. ft.
Nitrogen (in large cylinders) $1.20 per 100 cu. ft.

The total of all selling, general and executive expenses, interest and taxes was $76,375.

Required: From the foregoing information prepare the following statements:

a) Cost of production and sales
b) Profit and loss

Also show the calculations of operating data and the apportionment of costs.

(*Adapted from an American Institute of Accountants examination*)

21–4. The Copper Metal Mining Company has on hand, December 31, 19—, the following metals and ores:

Copper	1,000,000 lbs.
Silver	200,000 oz.
Gold	1,000 oz.
Metals in process (at cost)	$150,000.00
Ores on hand (at cost)	$ 10,000.00

The company did not operate during the previous year and had no inventory at the end of that year.

The costs, not including depletion for the current year, were as follows:

Mining	$2,500,000.00
Milling and concentration	1,400,000.00
Smelting and refining	660,000.00
Administrative and general expenses	200,000.00
	$4,760,000.00

Production of finished metals for the current year:

Copper	10,000,000 lbs.
Silver	1,800,000 oz.
Gold	15,000 oz.

Market prices of metals, December 31, 19—:

Copper	$ .26 per lb.
Silver (open market price)	.88 per oz.
Gold	35.00 per oz.

Average prices of metals realized during the year were:

Copper	$ .27 per lb.
Silver	.86 per oz.
Gold	35.00 per oz.

From the foregoing data, determine the profit or loss in the two ways named below, before depletion, for the year 19— and the value of the inventory at cost as of December 31, 19—, each metal being valued separately, on the bases (1) that copper is the principal metal and silver and gold are by-products, and (2) that each metal bears its own share of the costs.

Note: Where necessary round off decimals in the fifth place. Adjust last item in series. In the profit and loss statement, show all values to the nearest dollar.

21–5. During the month of July, the Chemical-Coke Company produces 60,000 tons of coke and recovers 250,000 gals. of tar sold at $.03 a gallon; 700 tons of sulphate of ammonia sold at $60 per ton; 300 million cu. ft. of gas sold at $100 per million cubic feet; and 3,200 tons of breeze and dust sold at $.50 per ton. The raw materials, direct labor, and overhead, as well as sundry operating and general works expenses, are shown below.

	Costs Applicable to the Production of			
	Coke	Tar	Sulphate of Ammonia	Gas
Coal	$200,000.00	–	–	–
Handling Coal	2,000.00	–	–	–
Lime	–	–	$ 1,000.00	–
Sulphuric Acid	–	–	8,000.00	–
Direct Labor	15,000.00	$ 800.00	2,000.00	$ 750.00
Steam, Water, Electric Light	3,000.00	500.00	1,000.00	600.00
General Yard and Switching	2,500.00	–	100.00	–
Laboratory	1,200.00	–	300.00	–
Operating Coolers and Exhausters	–	150.00	–	450.00
Operating Tar and Liquor Pump	–	300.00	200.00	–
Miscellaneous Supplies	1,200.00	20.00	200.00	150.00
Repairs and Maintenance	6,000.00	400.00	1,000.00	300.00
Provision for Relining and Renewals	1,200.00	–	–	–
Depreciation	1,500.00	300.00	500.00	600.00
General Plant Expenses	4,000.00	100.00	600.00	150.00
	$237,600.00	$2,570.00	$14,900.00	$3,000.00

Required: Prepare statement showing the costs of making coke, tar, sulphate of ammonia, and gas, also showing the cost per unit of production.

21–6. The National Meat Packing Company has purchased a lot of cattle on which the following costs and expenses are incurred:

1. Live cost, 46 heads, weight 52,390 lbs., native steers, at $32.00 per cwt.	
2. Expenses, killing, dressing, chilling (estimate for month)	$ 354.09
3. Allowance, condemnations, trimming, etc.	53.31
4. Net yield for hides cured	1,161.18
5. Net yield for fats	348.90
6. Net yield for other by-products	377.19
7. Selling and administrative expenses	1,662.00

The dressed carcasses weighed 29,615 lbs.

Required:

a) Cost of carcasses placed in cooler.
b) Total cost of lot.
c) Cost per cwt. of carcasses in cooler.
d) Total cost per cwt. of carcasses.

21–7. The Town Company is a manufacturer, producing two principal products known as XO and MO. Incidental to the production of these products, it produces a by-product known as Bypo. The company has three producing departments, which it identifies as Departments 101, 201, and 301. Raw materials A and B are started in process in Department 101. Upon completion of processing in that department one fifth of the material is by-product and is transferred directly to stock. One third of the remaining output of Department 101 goes to Department 201, where it is made into XO and the other two thirds goes to Department 301 where it becomes MO. The processing of XO in Department 201 results in a gain in weight of material transferred into the department of 50%, due to the addition of water at the start of the processing. There is no gain or loss of weight in the other processes.

The company considers the income from Bypo, after allowing five cents per pound for estimated selling and delivery costs, to be a reduction of the cost of the two principal products. The company assigns Department 101 costs to the two principal products in proportion to their net sales value at point of separation, computed by deducting costs to be incurred in subsequent processes from the sales value of the products.

The following information concerns the operations during April 1951:

INVENTORIES

	March 31		April 30
	Quantity (lbs.)	Value	Quantity (lbs.)
Department 101	None		None
Department 201	800	$17,160.00	1,000
Department 301	200	2,340.00	360
Finished stock—XO	300	7,260.00	800
Finished stock—MO	1,200	18,550.00	700
Finished stock—Bypo	None		None

Inventories in process are estimated to be one half complete in Departments 201 and 301, both at the first and last of the month.

COSTS

	Material Used	Labor and Burden
Department 101	$134,090.00	$87,442.00
Department 201	-	31,950.00
Department 301	-	61,880.00

The material used in Department 101 weighed 18,000 lbs.

SALES PRICES

XO—	$29.50 per lb.
MO—	17.50 per lb.
Bypo—	.50 per lb.

Prices as of April 30th are unchanged from those in effect during the month.

You are to prepare the following statements covering the operations of the Town Company. Present all supporting computations in good form.

a) Statement showing costs and production by departments for the month of April. The company uses first-in first-out to cost out production.

b) A schedule of inventory values for work in process and finished goods as of April 30.

(Adapted from an American Institute of Accountants examination)

21–8. From the following data prepare a statement of operating results of the Zinc Mining and Milling Company in October that will show the operations on the company's own account and its activities in furnishing milling services to others, both for zinc and for lead concentrates. Present all supporting schedules. Carry computations to the third decimal.

The Zinc Mining and Milling Company operates a mine and a mill for concentrating ore. The ore as it comes from the mines must be concentrated in the mill before being shipped to the smelters. The resulting zinc and lead concentrates amount to about 5% to 7% of the original weight. Both kinds of concentrates go through substantially the same milling processes. Zinc concentrates contain about 60% zinc, while lead concentrates contain about 80% lead.

The company, in addition to milling the rock produced in its own mine, does commercial milling for other mines in the neighborhood, accepting as compensation 20% of the concentrates produced. The amount of concentrates produced from the ores thus brought in is determined by assaying each carload of rock as it is received. This is necessary because (*a*) the ores from different mines differ in richness and (*b*) it is not practicable to mill different batches of ore separately.

The mining land and ore deposits are not owned by the company. A royalty of 12% of the selling price of concentrates produced from company ores must be paid to the owners. This royalty accrues as the concentrates are sold, royalty expense being charged and accounts payable credited at the end of the month in which sales are made.

The company develops its own power which is used 40% for mining operations and 60% in the mill.

Inventories of partially mined rock and of rock in process in the mill are constant and may be ignored for the purposes of this problem.

The following operating data are presented:

Cost of mining	$31,356.00
Cost of milling	11,326.00
Cost of power	6,292.00
General management	5,586.00
	$54,560.00

(The above costs include all labor, supplies, expenses, and depreciation.)

It is understood that the mining and milling expenses will be apportioned to the cost of zinc and lead concentrates on the basis of their sales value (known as the "joint product method") and that the general management expenses will not be absorbed in the production costs.

Note: Use first-in first-out method in valuing the inventory of mined rock at October 31. Use average cost method in valuing inventories of concentrates at October 31.

	Tons	Valued at
Mined rock on hand October 1	500	$ 615.00
Rock mined and brought to the surface in October	27,600	
Mined rock on hand October 31	1,500	
Rock owned by others milled in October	4,600	
Concentrates on hand October 1:		
Zinc—own product only	150	3,900.00
Lead—own product only	50	1,800.00
Concentrates produced in October, both own and for others:		
Zinc	1,810	
Lead	187	
Concentrates delivered to others after retaining company's share:		
Zinc	216	
Lead	24	
Concentrates on hand October 31:		
Zinc—own product only	125	
Lead—own product only	20	
Sales of concentrates in October:		
Zinc		66,379.00
Lead		11,001.00
Market price per ton of concentrates October 31:		
Zinc		42.00
Lead		58.00

21–9. From the following information, concerning Dart Company, prepare a statement showing the standard cost of producing 13,500 tons of X product for the purpose of bidding on a government contract.

Dart Company manufactures X, a main product, and Y, a by-product. X is produced and sold by the ton (2,000 lbs.). The raw materials used in production consists of three ingredients, "H," "I," and "J," contained in both the finished main and finished by-product in proportions and at standard costs per ton set forth below:

"H"—40% at $8 per ton
"I"—36% at $5 per ton
"J"—24% at $7 per ton

The contract for 13,500 tons of X represents 60% of the budgeted 19— production of X by Dart Company.

Main product X is manufactured through four processes, as follows:

Process No. 1—Ingredients "H" and "I" are issued at the outset of Process No. 1; completed work in process is transferred to Process No. 2.

Process No. 2—Ingredient "H," at the end of Process No. 2, suffers a 5% weight loss due to evaporation and 10% of the remaining work in process is sold as waste at a nominal amount of $6 per ton; completed work in process is transferred to Process No. 3.

Process No. 3—Ingredient "J," at the outset of Process No. 3, is mixed with work in process. Ingredient "J" loses 4% of its original weight due to evaporation at the end of Process No. 3.

Process No. 4—In this final process, the material is separated into main product X and by-product Y in the proportions of 80% and 20%, respectively, and such products are placed in salable form.

Standard direct labor per ton by processes is as follows:

Process	Direct Labor per Ton
No. 1	$5.00
2	2.50
3	3.00
4	4.00

Manufacturing overhead at standard capacity, i.e., 75% of a total plant capacity of 25,000 tons annually of X, is as follows:

Process	Variable	Fixed	Total
No. 1	$ 60,000.00	$30,000.00	$ 90,000.00
2	62,000.00	18,000.00	80,000.00
3	50,000.00	20,000.00	70,000.00
4	40,000.00	16,000.00	56,000.00
Total	$212,000.00	$84,000.00	$296,000.00

At the standard capacity level, general manufacturing overhead applicable to the factory as a whole amounts to $60,000, of which 40% is fixed. It is expected that the units called for by the government contract, coupled with the company's curtailed civilian production during 19— will reach 90% of total plant capacity measured in finished units of product X.

Product Y is expected to sell for an estimated $20 per ton, before deduction for handling, selling, and administrative expense of $2.50 per ton.

Carry all computations to two decimal places.

(Adapted from an American Institute of Accountants examination)

CHAPTER 22

22–1. From the information below prepare a monthly cash budget for AB Trading Company for the three months ending March 31, 1953.

AB Trading Company purchases merchandise on terms of 2/10, n/60, and regularly takes discounts on the tenth day after the invoice date. It may be assumed that one third of the purchases of any month are due for discount and are paid for in the following month.

The company's sales terms are 2/10, n/30, E. O. M. It has been the company's experience that discounts on 80% of billings have been allowed and that, of the remainder, one half have been paid during the month following billing and the balance during the second following month.

The average rate of gross profit based on sales price is 25%. Total sales for the company's fiscal year ending June 30, 1953, have been estimated at 80,000 units, distributed monthly as follows:

July	9%	October	9%	January	3%	April	7%
August	10	November	10	February	5	May	6
September	12	December	15	March	6	June	8

To insure prompt delivery of merchandise, inventories are maintained during January and February at 6% of the number of units estimated to be sold throughout the year, while during the rest of the year they are maintained at 10% of that number. The inventories at December 31 and February 28 should be at the levels intended to be maintained during the respective ensuing seasons.

Total budgeted selling, administrative, and general expenses for the fiscal year ending June 30, 1953, are estimated at $312,000, of which $120,000 are fixed expenses (inclusive of $24,000 annual depreciation). These fixed expenses are incurred uniformly throughout the year. The other selling, administrative, and general expenses vary with sales. In total, these expenses amount to $192,000 or 12% of total sales for the year. Expenses are paid as incurred, without discounts.

It is assumed that at January 1, 1953, merchandise inventory, at the 6% level, will consist of 4,800 units, to cost $72,000, before discount, and the cash balance will be $112,000.

(Adapted from an American Institute of Accountants examination)

22–2. A manufacturer wishes to enter the hosiery knitting business but lacks sufficient capital. Hoping to obtain the necessary additional funds from temporary bank loans by indicating substantial potential profits, he has requested that the following projected statements or budgets be prepared by quarters, starting with the third quarter in 1952 and ending with the quarter in which it is estimated that all bank borrowings have been liquidated:

a) Statements of cash receipts and disbursements.
b) Balance sheets.
c) Statements of profit and loss.

Prepare these statements and indicate what responsibility the public accountant should assume.

The statements are to be based upon estimates and assumptions furnished by the manufacturer as listed below.

1. It is proposed that the corporation will begin business on July 1, 1952, with a cash capital of $100,000, all paid in.

2. Knitting machinery consisting of eight units costing $170,000 will be ordered at once; delivery will require one month; and payment will be made as follows:

10% in cash with order.
10% in cash on delivery.
80% by notes dated August 1, 1952, maturing quarterly in equal amounts over two years, the first note falling due at the end of the 1st quarter of 1952. Interest at 6% will be paid quarterly on unpaid notes.

3. Auxiliary machinery will cost $8,000; factory furniture, fixtures, etc., will cost $2,000; both items will be purchased at once for cash.

4. Borrowings in units of $25,000 each, 6% interest (payable at the end of each quarter), will be made as required at the beginning of quarters; repayments of not less than $25,000 each will be made when possible at the end of quarters. Cash balances must be budgeted never to be less than $20,000.

5. Quarterly production of hosiery will be as follows:

4th quarter of 1952	4,000 dozen
1st quarter of 1953	6,000 dozen
Quarterly thereafter	24,000 dozen

6. Costs of production will be as follows:

Direct costs per dozen pairs of hosiery produced:	
Thrown silk (purchased on terms of 90 days net)	$ 3.00
Direct labor, dyeing, etc.	2.00
Factory overhead, by quarters:	
Starting at once	2,000.00
4th quarter of 1952	4,000.00
1st quarter of 1953	9,000.00
Quarterly thereafter	15,000.00

Depreciation of fixed assets at a composite rate of 8% per annum will be provided starting with the 4th quarter of 1952.

7. Selling expense will be $20,000 each quarter, starting at once.
8. General and administrative expense by quarters will be as follows:

Starting at once	$3,000.00
4th quarter of 1952	5,000.00
Quarterly thereafter	6,000.00

9. Hosiery manufactured will be sold at the following prices:

80% firsts at	$12.00 per dozen
20% seconds at	2.00 per dozen

With every four dozen firsts, one dozen seconds will be sold.

10. Customers' terms will be 30 days net. It will be assumed that payments will be received when due, that there will be no bad debts, and that each month's sales will equal one third of the quarter's sales.

11. Inventories of thrown silk will be one half of the consumption in the succeeding quarter.

12. Inventories of finished hosiery (it will be assumed that hosiery in process will be finished at the ends of quarters) will be as follows:

End of 4th quarter of 1952	1,000 dozen
End of 1st quarter of 1953	1,000 dozen
End of each quarter thereafter	4,000 dozen

13. Inventory valuation of finished hosiery will be based upon cost at maximum production.

14. Provision for federal income taxes will be made only at the close of the calendar years, and will not be considered in the preparation of the projected statements.

(Adapted from an American Institute of Accountants examination)

22-3. The X Company makes four products (A, B, C, and D) in three departments (1, 2, and 3). All products pass through Department 1 and then on to Department 2. These two departments are manufacturing departments; payment to all direct labor is on a piecework basis and the overhead in each department is allocated to the product at a percentage of the direct labor cost. Department 3 is a shipping department, and all costs in that department are allocated to the product based on a percentage of the total cost (raw material, direct labor, and overhead) as the product enters Department 3 from Department 2.

No breakage of product occurs in Department 3. In Departments 1 and 2 the following breakage occurred in 1953:

	Dept. 1	Dept. 2
Product A	20%	10%
Product B	12	8
Product C	10	5
Product D	5	3

In Departments 1 and 2 all operations, including those upon product discarded as broken, are paid for. Product broken has no value.

Raw material costs (as product enters Department 1) in 1953 follows:

Product A	$15.00 per unit
Product B	7.00 per unit
Product C	3.00 per unit
Product D	1.60 per unit

Direct labor piecework rates for processing one unit in 1953 follow:

	Product A	Product B	Product C	Product D
Department 1	$12.70	$6.30	$2.50	$1.30
Department 2	$10.10	$5.00	$2.10	$1.00

In Department 3 all labor is day work and is included in overhead as indirect labor.

In 1953 sales and cost of sales statement were as follows:

Sales—Product A—14,400 units at $100.00		$1,440,000.00
Product B—44,528 units at 50.00		2,226,400.00
Product C—25,650 units at 20.00		513,000.00
Product D—92,150 units at 10.00		921,500.00
Total Sales		$5,100,900.00
Cost of Sales		
Raw material	$ 935,000.00	
Direct labor	1,360,800.00	
Overhead		
Indirect labor	200,000.00	
Supplies	200,000.00	
Repairs	100,000.00	
Power, light, and heat	250,000.00	
Depreciation, taxes, insurance, factory supervision, and all other overhead	497,326.70	
Cost of Sales		$3,543,126.70
Gross Profit		$1,557,773.30

The inventories were the same at the beginning and end of the year in both quantity and value.

Based upon a study made, the overhead costs which are considered variable and semivariable are shown below, and the percentages allocated to each department follow:

	Dept. 1	Dept. 2	Dept. 3
Indirect labor (50% variable—50% fixed)	15%	10%	75%
Supplies (variable)	10	10	80
Repairs (variable)	50	45	5
Power, light, and heat (50% variable—50% fixed)	50	40	10

The 1953 overhead costs for depreciation, taxes, insurance, factory supervision, and all other overhead are considered fixed, and are allocated to departments as follows:

Department 1	$218,750.00
Department 2	200,390.00
Department 3	78,186.70
Total	$497,326.70

The sales department estimates that for 1954 sales will be:

Product A	18,000 units
Product B	36,432 units
Product C	25,650 units
Product D	73,720 units

You may assume that:

1. Raw material unit costs, direct labor, piecework rates, and breakage percentages will be the same in 1954 as in 1953.
2. Variable overhead costs in 1954 will be 90% of those in 1953.
3. Fixed overhead costs will be the same in 1954 as in 1953.
4. Inventories at the beginning and end of 1954 will remain the same in quantity and value.

Required: Calculate the cost of each of the four products (A, B, C, and D) on the basis of the 1954 sales estimate.

22–4. The Colt Manufacturing Company operates a budgetary control system. The results below summarize the budgeted and actual costs for the year ended December 31, 19—.

Sales		Budget	Actual
10,000 units at $15		$150,000	
12,000 units at $12.50			$150,000
Inventories			
Raw Materials, January 1, 19—			
A—40,000 lbs. at $.50		20,000	20,000
B—5,000 ft. at $1.00		5,000	5,000
Finished Goods			
3,000 units at $7.50		22,500	22,500
Production			
Estimated	11,000		
Actual	13,000		
Material Purchases			
A—60,000 lbs. at $.50		30,000	
A—50,000 lbs. at $.55			27,500
B—10,000 ft. at $1.00		10,000	
B—12,000 ft. at $.75			9,000
Material Consumption			
A—Estimated	77,000 lbs.		
A—Actual	78,000 lbs.		
B—Estimated	11,000 ft.		
B—Actual	13,000 ft.		
Labor		33,000	32,500
Manufacturing Overhead		16,500	19,500
Distribution Expenses		25,000	27,500
Administrative Expenses		15,000	12,500
Interest Charges		2,500	2,000

There is no work in process inventory. The company uses the first-in first-out method of charging out materials and finished goods.

Required:

a) Comparative statement of budgeted and actual manufacturing costs, cost of sales, and profit and loss for the year ended December 31, 19—.

b) Submit an analysis of the variance between the budgeted and actual costs of material used in production.

(Adapted from a Canadian Society of Cost Accountants and Industrial Engineers examination)

CHAPTER 23

23–1. From the following accounts of The Old Reliable Brewing Company for the year ended December 31, 19—, prepare separate statements of cost of sales of draught and packaged beer:

Brew House Operations:	Debits	Credits
Malt consumed	$1,129,980.80	
Hops consumed	229,554.16	
Grits consumed	373,812.72	
Sugar consumed	103,035.60	
Other materials consumed	35,805.20	
Wages	447,838.28	
Overhead expenses	429,710.92	
By-product sales (spent grains and yeast)		$38,828.40
Racking cost	88,512.03	
Federal excise tax on draught beer sold	847,080.00	
Cost of beer delivered to bottling department, credit		Amount to be determined
Bottling Department Operations:		
Cost of beer delivered from brew house, debit	Amount to be determined	
Federal excise tax on beer delivered from brew house	3,510,104.00	
Wages	780,257.20	
Crowns used	227,317.68	
Labels used	42,294.36	
Nonreturnable containers used	878,188.04	
Overhead	541,441.24	

ADDITIONAL DATA:

Draught beer is sold and shipped in barrels direct from the brew house. Putting the beer in the barrels is termed "racking."

Packaged beer is sold and shipped from the bottling department in bottles or cans placed in cases or cartons.

Federal excise taxes are incurred on draught beer when shipped by placing the appropriate stamps upon the racked barrels at the rate of $8 per barrel. On packaged beer the federal excise tax is incurred on the quantity of beer, in terms of barrels, passing through a meter from the brew house to the bottling department at the rate of $8 per barrel, the required amount of stamps being destroyed at regular intervals in the presence of a government representative.

Brew House Inventories:

January 1, 19—	
Racked beer, 124 barrels	$ 588.12
Beer in storage cellar vats, 64,980 barrels	303,745.32
December 31, 19—	
Racked beer, 880 barrels, valued at	5,009.00
Beer in storage cellar vats, 72,416 barrels, valued at average brew house cost to be determined	

Bottling Department Inventories:

January 1, 19—	
Packaged beer	22,378.44
Unpackaged beer in tanks	55,113.24
December 31, 19—	
Packaged beer	90,870.72
Unpackaged beer in tanks	48,724.00
Number of barrels of beer brewed during 19—, net of waste and employee consumption	552,840
Number of barrels of beer delivered to bottling department by brew house during 19—	438,763

Inventories are valued on the first-in first-out basis.

23–2. The Lasko Mining Company is engaged solely in processing all the ore taken from its own mine into a concentrate called "Oxylite" and selling it to refineries.

The books show the following inventories on hand at the beginning and end of the year:

	January 1	December 31
Raw ore	50,000 tons	20,000 tons
Partly processed ore	5,000 "	15,000 "
Oxylite	25,000 "	5,000 "

Raw ore was carried at $4 and $4.345 per ton at the beginning and end of the year, respectively, which values were described as "annual average market prices." Ore produced at the mine—200,000 tons—had likewise been charged to mining costs throughout the year at $4.345 per ton and corresponding credits aggregating $869,000 had been made to a separate "earnings" account.

Partly processed ore was inventoried respectively at $4.40 and $4.7795 per ton, being 10% above the ore values. During the year 20,000 tons of ore were lost in the final stages of the reducing processes.

Costs per ton of materials in the opening inventories were found to be as follows:

Raw ore	$1.0428
Partly processed ore	1.27
Oxylite	4.328

It was agreed that partly processed ore in both opening and closing inventories had passed through about one tenth of the reduction processes and should therefore be carried at a cost per ton equalling the cost of raw ore plus one tenth of the cost per ton of processing.

Oxylite was carried at $8.39 per ton, a value that was derived from a formula established many years ago and used ever since in pricing the stock on hand.

Mining expenses, including depletion, were $198,900 and the expenses of the reducing plant $629,850, including depreciation. Both amounts had been charged to reducing plant expenses.

Because of the foregoing arbitrary methods the books did not show acceptable costs and values. It was accordingly decided to restate the current year's accounts and show proper costs and inventory values, all on the first-in first-out plan.

The sales of oxylite aggregated $1,168,200.

From the foregoing data prepare a comparative statement of mining and reducing costs, cost of sales and gross profit, following (*a*) the company's and (*b*) the revised method. Each method should show computations of aggregate and unit costs.

(Adapted from an American Institute of Accountants examination)

23–3. The Miracle Chemical Company manufactures two products, Mirachem and Corim. Both are made from the same raw materials in the same proportions. In addition to a difference in packaging, Corim is processed in Department B and Mirachem is not.

The plant of the company is divided into four departments, A, B, C, and D. Materials suffer a shrinkage of 16⅔% in Department A, a shrinkage of 20% in Department B, a shrinkage of 10% in Department C, and no shrinkage in Department D.

The materials are mixed in Department A at a cost for labor and overhead of $.10 per pound of finished mixture. The materials used are X, which costs $1.10 per pound, Y which costs $.15 per pound, and Z which costs $.40 per pound. They are mixed in the proportion of 1 lb. X to 8 lbs. Y to 3 lbs. Z, comprising the unit for calculation. Assume that materials and packages are purchased in quantities just sufficient to cover the sales requirements.

Labor and overhead in Department B amount to $.09 per pound of material delivered to the department.

In Department C an amount of water equal to the weight of the material received is added. Labor and expenses including water in this department amount to $.05 per pound of material finished.

Department D is the packaging department. Labor and expenses exclusive of the packages cost $.05 per pound of Mirachem handled and $.07½ per pound of Corim handled. Packages for Corim holding 4 oz. of the finished product cost $.05. Packages for Mirachem of the same size cost $.02½. Corim is sold at $.50 and Mirachem at $.25 a package, and the total dollar sales are equally divided between the two products.

General and administrative expenses, including advertising, amount to $90,000 a year.

From the foregoing data prepare a statement of profit and loss in the usual columnar form, showing an aggregate net operating profit of 20% on the sales; also showing for each product the number of packages sold and the gross profit; and for each product and each department the materials and supplies purchased and used as well as the labor and expenses.

23–4. The Special Product Manufacturing Company valued its finished-product inventory on the basis of average yearly production cost and its raw-material inventory on the basis of first-in first-out cost. Due to continuous fluctuation in the market price of the basic raw material used, the management proposes to change its inventory valuations from the cost basis to the basis of lower of cost or market.

The company inventory values at the beginning and end of 19— were as follows:

Raw materials:	January 1	December 31
Tons on hand	2,000	1,000
Book value on first-in first-out basis	$53,000.00	$22,500.00
Market value, per ton	$ 20.00	$ 30.00
Finished product:		
Tons on hand	750	900
Book value at average yearly cost	$38,000.00	$36,000.00
Market value, per ton	$ 50.00	$ 55.00

Costs other than raw materials have remained constant throughout the year and were the same as in the preceding year. In 19—, 19,000 tons of raw materials were bought at a total cost of $400,000. Shrinkage and waste in the manufacturing process amount to 25% of the materials used.

Before making a decision, the management requests that you first show the result of changing from one basis to the other.

Prepare a comparative statement showing (*a*) the present and revised values and costs and the effect of the proposed change upon the December 31 balance sheet; also (*b*) prepare the entry that would bring the books into agreement with the new plan if adopted.

(*Adapted from an American Institute of Accountants examination*)

23–5. From the information submitted hereafter relative to a canceled production contract of Tad Company, Inc., prepare a statement of undelivered inventories at cost plus an allowance for general and administrative expenses applicable to the contract as at March 31, 1953, date of cancellation.

On November 18, 1952, Tad Company, Inc. contracted with a consumer to deliver 10,000 units of "meti" to the latter as and when finished. By mutual agreement this contract was canceled as of March 31, 1953, and the contracting parties have agreed to use a statement of undelivered inventories at cost plus an allowance for general and administrative expenses as at

March 31, 1953, as a basis for negotiating settlement. There is also an understanding between Tad Company, Inc. and the supplier of raw materials used in "meti" that any raw materials in excess of that applicable to the entire contract may be returned to the supplier who will accept at cost on the basis of most recent purchases.

"Meti" is processed successively through Departments 20 and 30 and is the sole product of these departments except for tools made and used in Department 20 for "meti."

"Meti" is made from two raw-material ingredients identified as O and P, which are issued at the outset of processing in Department 20. Two units of O and one unit of P enter into one unit of "meti."

Production data:

1. No inventories were on hand at November 18, 1952, date of contract.
2. 1,500 units of "meti" had been delivered to the consumer under the contract as at December 31, 1952.
3. Applicable inventories as at January 1, 1953, follow:
   a) Raw materials:
      O—2,000 units at $3.00
      P—1,000 units at 1.80
   b) Work in process:
      Department 20—800 units estimated to be 40% complete; cumulative cost, $11,200.
      Department 30—600 units estimated to be 30% complete; cumulative cost, $19,700.
   c) Finished goods—none
4. Raw materials purchased from January 1 to March 31, 1953, follow:
   16,000 units of O at $3.50 per unit
   5,100 units of P at 2.00 per unit

   Raw materials were issued on a first-in first-out basis, as required.
5. Other costs and charges from January 1 to March 31, 1953, are:

	Dept. 20	Dept. 30
Direct labor	$40,000.00	$48,000.00
Direct departmental manufacturing overhead	50,000.00	60,200.00
General manufacturing overhead	5,600.00	6,720.00

6. Contract inventories at March 31, 1953
   Department 20—500 units, 40% complete
   Department 30—800 units, 70% complete
7. Work in process inventories as at March 31, 1953 are to be stated on the basis of current costs incurred from January 1 to March 31, 1953 without averaging therein beginning inventories as at January 1, 1953.
8. 5,700 units of "meti" were delivered to the consumer under the contract from January 1 to March 31, 1953.

9. General manufacturing overhead from January 1 to March 31, 1953, totaling $56,000, is prorated to departments in proportion to direct labor cost. The total direct labor cost for all departments, including Departments 20 and 30, is $400,000.
10. Past experience shows that general and administrative expenses may be applied at the rate of 15% of cost of sales. This percentage is deemed fair as an allowance on the cost of inventories.
11. An examination of the production data furnished discloses the following:
    - *a*) Direct labor, Department 20, includes $3,000 of labor expended in making tools. Materials going into such tools, amounting to $6,000, are included in direct manufacturing overhead. Direct manufacturing and general manufacturing overheads are applicable in proportion to direct labor. Forty per cent of the tools manufactured have been completely used; the remaining tools have depreciated 60% but can be used on other lines of manufacture.
    - *b*) Direct labor, Department 20, other than that applied to tools, is overstated $1,200 as a result of clerical errors in labor pricing totaling $200, and of an incorrect classification of an indirect labor item of $1,000.
    - *c*) Direct manufacturing overhead, Department 30, includes a loss of $800 on the sale of a machine used in that department. The company failed to accrue depreciation of $200 from March 1 to March 22, the date of sale.
    - *d*) The records do not reflect a vendor's cancellation claim of $300 (400 units of P at $.75) arising out of the contract cancellation. This claim is investigated and found to be proper.

Note: Carry out decimals to two places.

(*Adapted from an American Institute of Accountants examination*)

CHAPTER 24

24–1. The Johnson Meat Packing Company desires to study its distribution costs (selling, administrative, and general expenses) which in the aggregate constitute 65% of the total cost of doing business. From the information following, prepare an exhibit showing the allocation of total distribution cost per cwt. of meat products for each size-class of order (expressed in pounds per order). Carry out unit costs to hundredths of a cent.

An analysis made to determine basic causes of cost variation in selling, administrative, and general expense items discloses that each element of expense varies according to one of the following three bases: (1) number of orders; (2) number of items or invoice lines per order; and (3) weight of order expressed in cwt. Expenses varying according to these three factors account for the total distribution cost of a given order.

The analysis of each class of distribution expense discloses that these expenses are attributable to each of the three factors as follows:

	Expenses Based on			
Distribution Cost Controls	Number of Orders	Number of Items	Number of Cwt.	Total
Selling expense control	$2,310.00	$1,080.00	$ 210.00	$3,600.00
Packing and delivery expense control	260.00	320.00	620.00	1,200.00
Administrative and general expense control	1,170.00	580.00	340.00	2,090.00
Total distribution cost	$3,740.00	$1,980.00	$1,170.00	$6,890.00

Data by order-size classes follow:

Order-Size Class	Number of Orders	Total Number of Items	Total Cwt.
Under 50 lbs.	2,800	4,090	700
50-199 "	2,900	8,410	2,610
200-499 "	600	2,280	1,860
500-999 "	400	2,400	2,800
1,000 lbs. and over	100	820	1,030
All orders	6,800	18,000	9,000

(Adapted from an American Institute of Accountants examination)

24–2. Prepare a schedule showing sales, costs, and operating net income for each line of goods distributed by the Argo Grocery Company. Furnish supporting schedules indicating clearly how the items of expense have been apportioned. Show results only to the nearest dollar.

The Argo Grocery Company manufactures and distributes in a limited area two lines of grocery products. One line is distributed to hotels and restaurants, the other to retail grocers. Selling organizations for the two lines are separately set up and operated, and there is considerable rivalry between them. There is also a good deal of argument about which line nets the greater income to the company. Total dollar volumes of the two lines are roughly equal, but on account of competitive conditions the margins in the restaurant line are relatively narrow while wider margins are enjoyed by the retail line. From this fact the sales manager for the retail line argues that his line contributes more to the company's net income. The restaurant sales manager, however, insists that the distribution costs per dollar of sales for his line are sufficiently lower to make up for the difference in margin.

In an attempt to settle the argument the following facts about the company's business have been ascertained:

Both lines are stored in a single warehouse, and packing and shipping activities are carried on by the same crew. The restaurant line consists of ten items and is sold in shipping containers supplied by the factory and included as part of factory cost. The retail line consists of fifty items. The goods must be assembled and packed in containers after orders are received. Time studies indicate that it takes about four times as long to prepare $100 worth (at selling price) of retail goods for shipment as in the case of restaurant goods. Restaurant goods are delivered at the warehouse dock to customers' trucks or to common carriers; in the latter case the customers pay the freight. The company's own delivery equipment is used entirely for the retail line.

Advertising is directed entirely at the ultimate consumer, with the aim of persuading him to demand the company's products at stores and in public eating places. It consists of newspaper advertising and of display matter and leaflets supplied to dealers. About 10% as much newspaper space is devoted to the restaurant line as to the retail line. The company's advertising staff consists of one man, who spends two thirds of his time on newspaper advertising and the balance on display and leaflet material.

Schedule 1 lists the operating expenses of the company other than those concerned with manufacturing. Schedule 2 lists important operating data ascertained in the course of your investigation. The apportionment of office and clerical time is the result of time studies and estimates. It is the opinion of the management that office supplies and equipment expense roughly parallel the office and clerical salaries. The management rejects as inadmissible the inclusion of interest on investment. Approximately one half of the time of credit and collection employees is spent in routine checking of orders for credit approval. The balance is spent on credit followups and attempts to collect specific accounts. Experience indicates that the average retail account is about five times as likely to require such collection effort as the average restaurant account.

Historical records show that about ½ of 1% of retail sales are never collected, while only ⅒ of 1% of restaurant sales prove to be uncollectible.

Ninety per cent of the job of keeping warehouse stock records is concerned with shipments and 10% with receipts from the factory. All items of the restaurant line are received at the warehouse every day, but items in the retail line are received on the average only every other day.

EXPENSE DATA

SCHEDULE 1

Sales force salaries and expense:	
Restaurant line	$15,000.00
Retail line	35,000.00
Warehouse depreciation, insurance, etc.	4,000.00
Packing and shipping wages	10,000.00
Shipping containers	800.00
Other shipping supplies (proportionate to number of sales invoices)	600.00
Delivery wages, supplies, and expense	3,000.00
Newspaper advertising	11,000.00
Display material and dealers' helps	2,500.00
Advertising salary	1,650.00
Office and clerical salaries (see Schedule 2)	5,000.00
Office supplies and equipment expense	1,600.00
Executive salaries and expense (apportion on basis of sales)	8,000.00
Bad debts allowance	1,590.00
Total	$99 740.00

OPERATING DATA — SCHEDULE 2

	Restaurant	Retail
Sales	$240,000.00	$270,000.00
Factory cost of sales	200,000.00	180,000.00
Warehouse space occupied by $100 worth, at cost	30 cu. ft.	60 cu. ft.
Average inventory, at cost	$ 20,000.00	$ 40,000.00
Number of sales invoices	1,000	9,000
Average number of items per invoice	4	12
Number of customers	28	224
Average customers' accounts outstanding	$ 20,000.00	$ 40,000.00

Analysis of office and clerical time:	%
Keeping warehouse stock records	5
Preparing order and sales invoice forms	25
Posting sales invoices	15
Receiving cash and posting cash receipts	5
Preparing customers' statements	5
Credit and collection activities	10
General accounting and clerical (apportion on basis of sales)	35
	100

(Adapted from an American Institute of Accountants examination)

24–3. The Purity Baking Company, Inc. owns and operates a bread delivery company consisting of three routes, two of which operate at a profit. The company buys the bread at wholesale from a baking company and delivers it to the consumers each morning, six days a week. The bread is sold at an average price of $.15 per pound and costs $.10 per pound.

The company employs four people: a bookkeeper-clerk at $207 per month, who handles the entire office routine, and three drivers at $175 per month plus 7% commission on sales. The drivers pay for all merchandise they receive. No returns are permitted. Mr. Metz, the president, draws a salary of $650 per month.

The company owns and operates three trucks which cost $1,800 each when purchased and are now three years old. It is estimated that their useful life will end in two more years; they are housed at a public garage at a total rental of $120 per month. Gas, oil, tires, repair service, and truck insurance cost $546 per month.

The company conducts its business from a rented office costing $75 per month. Light, telephone, stationery, and miscellaneous expenses amount to $60 per month.

Mr. Metz believes that the way to turn the losing route into a profitable one is to put more business on it and he plans to extend its coverage to include additional territory. He estimates that the additional sales will amount to $390 a month and add 20 miles of route per day.

At present, Route 1 covers an average of 50 miles per day; Route 2 covers 70 miles; Route 3 covers 90 miles. The average sale is 2 lbs. of bread per customer per day.

The general expenses are to be allocated equally among the three routes; compute depreciation of trucks on the basis of mileage and assume truck expenses of $.10 per mile covered by each truck. Assume an average of 26 working days per month.

The following schedule was derived from the record:

PURITY BAKING CO., INC.

PROFIT AND LOSS STATEMENT FOR OCTOBER, 19—
(By Routes)

	Total	Route 1	Route 2	Route 3
Sales	$8,970.00	$3,120.00	$3,198.00	$2,652.00
Cost of Sales	5,980.00	2,080.00	2,132.00	1,768.00
Gross Profit	$2,990.00	$1,040.00	$1,066.00	$ 884.00
Operating Expenses:				
Drivers' Salaries	$ 525.00	$ 175.00	$ 175.00	$ 175.00
Drivers' Commissions	628.00	218.00	224.00	186.00
Office Salaries	207.00	69.00	69.00	69.00
Officer's Salary	650.00	217.00	217.00	216.00
Truck Expense	546.00	182.00	182.00	182.00
Depreciation on Trucks	90.00	30.00	30.00	30.00
Rent—Garage	120.00	40.00	40.00	40.00
Rent—Office	75.00	25.00	25.00	25.00
Heat, Light, etc.	60.00	20.00	20.00	20.00
Total Operating Expenses	$2,901.00	$ 976.00	$ 982.00	$ 943.00
Net Profit for Month	$ 89.00	$ 64.00	$ 84.00	$(59.00)

Required:

a) Revised statement of profit and loss.

b) Corrected statement of profit and loss for Route 3 giving effect to the increased sales.

24–4. The X Products Corporation is a selling organization, organized for the sole purpose of selling the products of the X Resins Corporation.

The products consist of chemical resins and compounds and can be broken down into five main classifications: carbide, formvar, acetic acid, black carbon, and gelva.

The X Products Corporation acquires the total output of the X Resins Corporation at a specific price. The X Products Corporation then handles all selling activities, assuming all distribution costs.

The company breaks down its market into three territories; because of the limited number of customers, a sales force of 15 men is all that is necessary to be maintained. Five salesmen are assigned to each territory. Each receives a base salary of $100 per month plus a commission amounting to 1.5% of gross sales. New York is the only office maintained. All administrative work is done there and all sales activity originates there.

Mr. Kaumerer, the president of the corporation, is desirous of knowing the amount of profit earned through the sale of each product in each territory. The following data are furnished for the year ending December 31, 19—:

	Pounds Sold	Dollar Sales	Cost of Sales	No. of Transactions
Territory I				
Carbide	16,100,000	$713,000.00	$621,000.00	828
Formvar	448,000	360,000.00	323,200.00	192
Acetic acid	4,536,000	198,000.00	160,200.00	270
Black carbon	3,388,000	440,000.00	402,600.00	110
Gelva	1,386,000	325,500.00	291,900.00	252
Territory II				
Carbide	10,500,000	465,000.00	405,000.00	540
Formvar	560,000	450,000.00	404,000.00	240
Acetic acid	4,284,000	187,000.00	151,300.00	255
Black carbon	2,310,000	300,000.00	274,500.00	75
Gelva	1,188,000	279,000.00	250,200.00	216
Territory III				
Carbide	8,400,000	372,000.00	324,000.00	432
Formvar	392,000	315,000.00	282,800.00	168
Acetic acid	3,780,000	165,000.00	133,500.00	225
Black carbon	2,002,000	260,000.00	237,900.00	65
Gelva	726,000	170,500.00	152,900.00	132

The expenses for the year were as follows:

Salesmen's salaries	$ 18,000.00
Salesmen's commissions	75,000.00
Executive salaries	50,000.00
Office salaries	67,000.00
Traveling expenses	26,000.00
Rent—general office	12,000.00
Rent—warehouse	26,000.00
Electric light and heat—general office	2,000.00
Electric light and heat—warehouse	1,000.00
Postage	2,000.00
Insurance	3,000.00
Legal and auditing expense	5,000.00
Telephone and telegraph	6,000.00
Shipping expenses	12,000.00
Advertising	8,000.00
Miscellaneous expenses	2,000.00
Depreciation, sales equipment	7,000.00
Printing and stationery	3,000.00
Total expenses	$325,000.00

In distributing the expenses to the territories the following bases of allocation were used:

Salesmen's salaries, traveling expenses, and shipping expenses were considered direct expenses of each territory and were distributed as follows:

	Territory I	Territory II	Territory III
Salesmen's salaries	$6,000.00	$6,000.00	$6,000.00
Traveling expenses	9,000.00	9,000.00	8,000.00
Shipping expenses	4,500.00	3,500.00	4,000.00

Salesmen's commissions were 1.5% of sales.

It is estimated that executives directed 40% of their time to Territory I, 36% for Territory II, and 24% for Territory III.

Office salaries; rent—general office; electric light and heat—general office; postage; legal and auditing expenses; telephone and telegraph; printing and stationery; and miscellaneous expenses were allocated on the basis of the number of transactions within each territory.

Rent—Warehouse and Electric Light and Heat—Warehouse were allocated on the basis of poundage sold within each territory.

Insurance was allocated on the basis of cost of goods sold.

Advertising was allocated on an estimated percentage of benefit derived from it by each territory. It was estimated that Territory I received 55%; Territory II, 25%; and Territory III, 20%.

Depreciation on sales equipment: each salesman is assigned an automobile; therefore, the part of the expense applicable to the automobile depreciation is considered a direct expense. This amounts to $1,000 for each territory. The balance of the expense was allocated on the basis of number of transactions within each territory.

The bases of allocation of the expenses which were used in the analysis by products sold within each territory consisted of the following:

Salesmen's salaries, executive salaries, traveling expenses, and depreciation on sales equipment were allocated on the basis of number of transactions involved in the sales of each product.

Shipping expense was allocated on the basis of poundage of each product sold.

Advertising was allocated on the basis of net sales.

All other expenses were allocated on the same bases as those used in the analysis by territories.

With the foregoing data at hand, it is requested by the president of the corporation that you submit to him those statements necessary to show the profit earned by each territory and for each product in Territory I (omit cents).

24-5. Selective Distillers, Inc. manufactures, imports, and sells liquors. A plant in Pennsylvania and one in Kentucky supply most of the raw alcohol. The raw alcohol is distilled and aged at the plants. Five major products are sold by the company, and all but Scotch whisky are manufactured at the company's plant. Cost of packing and warehousing at the plants are figured in the standard manufacturing costs used by the company.

For those states where liquor is retailed in privately owned stores, the company has set up three geographic divisions: Eastern, Western, and Central with division offices in New York, San Francisco, and Chicago respectively. A fourth division handles the sales in those states operating state-owned stores. Salesmen are employed by the company and are assigned to divisions. They do not take orders, but function as representatives

SELECTIVE DISTILLERS, INC.

STATEMENT OF PROFIT AND LOSS

(By Divisions—Direct Divisions Costs Allocated)

	Total	Main Office	Eastern	Western	Central	State Stores
Gross Sales	$60,090,000		$20,030,000	$15,025,000	$13,019,000	$12,016,000
Less: Returns and Allowances	$ 25,000		$ 5,000	$ 10,000	$ 6,000	$ 4,000
Sales Discounts	65,000		25,000	15,000	13,000	12,000
	$ 90,000		$ 30,000	$ 25,000	$ 19,000	$ 16,000
Net Sales	$60,000,000		$20,000,000	$15,000,000	$13,000,000	$12,000,000
Cost of Goods Sold	50,000,000		16,000,000	13,000,000	11,000,000	10,000,000
Gross Margin	$10,000,000		$ 4,000,000	$ 2,000,000	$ 2,000,000	$ 2,000,000
Operating Expenses:						
Transportation	$ 200,000	$ 160,000	$ 5,000	$ 10,000	$ 15,000	$ 10,000
Advertising	1,000,000	1,000,000				
Selling Expenses	1,200,000	600,000	200,000	150,000	110,000	140,000
Administrative Expenses	300,000	300,000				
Service Charge by Holding Co.	200,000	200,000				
Royalties	800,000	800,000				
Total Operating Expenses	$ 3,700,000	$3,060,000	$ 205,000	$ 160,000	$ 125,000	$ 150,000
Operating Profit	$ 6,300,000					
Income Taxes	3,500,000					
Net Income	$ 2,800,000					

attempting to promote sales. Salesmen are on a straight salary basis plus a bonus based on an incentive plan.

Selective Distillers is a subsidiary of another company and is charged each month for administrative services including tax work, cashier service, and other technical assistance.

The profit and loss statement sets forth the results of operations for the company. Gross profit is shown by divisions and only ***direct operating expenses*** have been distributed to divisions.

Schedules A and B present a detailed listing of selling and administrative expenses.

Schedule C shows the distribution of main office transportation by products. This cost is to be distributed on the basis of case sales: an individual rate per case is developed for each product as a basis for distribution of the main office transportation costs to divisions. Within each division transportation costs are allocated to products on the basis of case sales in the particular division.

The distribution of advertising expense is to be made on a combined basis as is shown in Schedule D.

Schedule E lists the case sales by product and division. Royalties are paid the parent company for use of brand names on gin and preferred liquor only and are based on case sales of these products.

The detailed case sales of one product, gin, by size of bottle are given in Schedule F. While similar records are kept for all products, an analysis of the relative profitability of different sizes of bottles for one product will serve to illustrate the technique used.

Required: Prepare the following statements using case sales as a basis for applying costs unless otherwise specified.

a) Profit and loss statement by divisions.
b) Profit and loss statement by products.
c) Profit and loss statement by size of bottle for gin. (Do not allocate federal income tax.)

SCHEDULE OF SELLING EXPENSES

SCHEDULE A

Account	Amount
Administrative and Supervisory Payroll	$ 400,000
Selling Representative Payroll	300,000
Clerical Payroll	100,000
Payroll Taxes	10,000
Rent and Heat	40,000
Repairs and Maintenance	5,000
Travel Expense	246,600
Outside Storage	60,000
Depreciation	1,400
Light	6,000
Telephone and Telegraph	6,000
Insurance, Taxes, Licenses	25,000
	$1,200,000

SCHEDULE OF ADMINISTRATIVE EXPENSES SCHEDULE B

Account	Amount
Administrative and Supervisory Payroll	$ 100,000
Clerical Payroll	117,000
Payroll Taxes	10,000
Rent and Heat	40,000
Repairs and Maintenance	5,000
Travel Expense	20,000
Depreciation	1,000
Light	4,000
Telephone and Telegraph	1,000
Insurance, Taxes, Licenses	2,000
Total	$ 300,000

SCHEDULE OF MAIN OFFICE TRANSPORTATION CHARGES BY PRODUCTS SCHEDULE C

Gin	$ 40,000
Preferred	80,000
Scotch	20,000
Bond	10,000
Rum	10,000
	$ 160,000

ADVERTISING BY PRODUCTS AND BY MEDIA SCHEDULE D

Product	Total	News-papers	Magazines	Billboards	Display and Pamphlets
Gin	$ 300,000	$200,000	$ 50,000		$ 50,000
Preferred	500,000	400,000		$20,000	80,000
Scotch	155,000	50,000	90,000	2,000	13,000
Bond	20,000	15,000			5,000
Rum	25,000	15,000			10,000
Totals	$1,000,000	$680,000	$140,000	$22,000	$158,000

Newspaper advertising is allocated to territories based on schedules submitted by the publishers as follows: Eastern $320,000; Western $140,000, Central $120,000, State Stores $100,000. Billboards are maintained in but two territories and the cost allocated $12,000 to Eastern and $10,000 to Western. Magazine advertising and display and pamphlets are allocated to territories based on case sales. A separate rate is developed for each product as a basis for territorial distribution.

CASE SALES BY PRODUCTS AND DIVISIONS SCHEDULE E

	Total	Eastern	Western	Central	State Stores
Gin	400,000	175,000	80,000	85,000	60,000
Preferred	1,200,000	600,000	200,000	180,000	220,000
Scotch	300,000	120,000	80,000	60,000	40,000
Bond	50,000	10,000	–	40,000	–
Rum	50,000	15,000	–	5,000	30,000
Totals	2,000,000	920,000	360,000	370,000	350,000

ANALYSIS OF GIN CASE SALES

SCHEDULE F

	No. of Cases	Sales	Cost of Sales
Quarts	100,000	$ 3,150,000	$2,700,000
Fifths	200,000	5,120,000	4,320,000
Pints	60,000	1,385,000	1,170,000
Half Pints	30,000	840,000	720,000
Miniatures	10,000	105,000	90,000
Totals	400,000	$10,600,000	$9,000,000

NET SALES AND COST OF SALES BY PRODUCTS

SCHEDULE G

	Cost of Sales	Net Sales
Gin	$ 9,000,000	$10,600,000
Preferred	30,000,000	37,050,000
Scotch	8,700,000	9,262,500
Bond	1,050,000	1,543,750
Rum	1,250,000	1,543,750
	$50,000,000	$60,000,000

CHAPTER 25

25–1. The Euclid Company, located in Long Island City, New York, assembles a medium-priced vacuum cleaner which is sold through retail dealers. Their sales force is composed of four three-man groups, Groups A and B operating in Territory I; Group C in Territory II; and Group D in Territory III.

The following data for the year 19— are presented to you:

1. Standard Selling Price—$25.
   Standard Manufacturing Cost—$20.
2. Estimated number of cleaners to be manufactured and sold—150,000.
3. Standard sales data:

Sales Force	Sales Quotas	Salaries	Estimated Number of Sales Orders	Estimated Number of Accounts
A Group	$1,250,000.00	$12,000.00	1,800	500
B Group	900,000.00	10,800.00	1,500	370
C Group	850,000.00	10,500.00	1,200	230
D Group	750,000.00	9,000.00	800	200
	$3,750,000.00	$42,300.00	5,300	1,300

Per diem allowance to salesmen is made on basis of 240 days a year; standard allowance for Groups A, B, and C is $12 per day, Group D $10 per day. Travel allowance is $.07 per mile. Estimated miles traveled are as follows: A 15,000, B 12,000, C 10,000, and D 8,500.

4. The following sales expenses are to be distributed on basis of sales quotas:

Territory office expense	$25,500.00
Sales manager's salary	12,000.00
Home office selling expense	70,000.00

5. Standard administrative expenses are as follows:

	Amount	Basis of Distribution
Administrative salaries	$50,000.00	Sales quotas
Accounting and statistics	9,000.00	No. of sales orders
Credit and collection expenses	3,500.00	No. of accounts
General office expenses	12,500.00	Sales quotas

The following data were derived from the records of operations for the month ended January 31, 19—.

1. Sales Groups	Sales Salaries	Salesmen's Traveling Expenses	Miles Traveled
A	$1,000.00	$800.00	1,250
B	900.00	770.00	1,000
C	875.00	720.00	800
D	750.00	650.00	700

2. Sales manager's salary	$1,000.00
3. Office expenses by territories:	
1	$1,500.00
2	700.00
3	250.00
4. Home office selling expenses	5,800.00
5. Administrative expenses:	
Administrative salaries	4,300.00
Accounting and statistics	750.00
Credit and collection expenses	325.00
General office expenses	1,100.00

Units sold during January amounted to 7,500, distributed as follows:

A	2,600
B	2,100
C	1,500
D	1,300
	7,500

Required:

a) A comparative statement showing the standard selling and administrative expenses for each sales group and territory. Indicate the standard selling and administrative distribution rates for sales groups.

b) A schedule of actual selling and administrative expenses for sales groups and territories, showing variances from total selling and administrative expenses applied to January. The bases for distributing the yearly standard selling and administrative expenses are to be used in distributing the actual January expenses.

c) Comparative profit and loss statement for sales groups and territories for the month ended January 31, 19—. Variance may be considered to have been the result of seasonal conditions. This is true of both selling and administrative variances.

25–2. Arkin Distributors, Inc., a wholesale merchandising organization, uses standards for distribution costs. The following information was derived from their records for June, 19—:

Function	Factors of Variability	Budgeted Expense	Actual Expense	Standard Number of Units	Actual Number of Units
Warehousing	Cwt.	$ 958.40	$ 880.20	47,920	48,900
Selling					
Salaries	Calls	2,125.00	1,980.00	1,700	1,650
Traveling	Miles	1,050.00	1,045.50	21,000	20,500
Variable Administrative	Calls	425.00	429.00	1,700	1,650
Advertising					
Direct Mail	Pieces	2,000.00	1,710.00	20,000	19,000
Publications	Circulation	420.00	465.00	14,000	15,000
Dealers' Helps	Pieces	1,300.00	1,296.00	2,600	2,700
Receive and Route Orders	Orders	290.00	309.75	2,900	2,950
Take Order	Orders	53.00	45.00	1,060	1,000
Deliver	Cwt.	1,356.00	1,372.00	33,900	34,300
Load	Cwt.	140.20	160.60	14,020	14,600
Bill	Lines Billed	178.50	174.00	5,950	6,000
Collect	Remittances	100.40	101.68	2,510	2,480
Fixed Administrative	–	1,424.50	1,400.00		
		$11,821.00	$11,368.73		

Required: A schedule setting forth for each function its standard unit cost, actual unit cost, total variance, efficiency variance, and price variance.

CHAPTER 26

26–1. The Boylston Manufacturing Company made $70,000 gross profit in 1950 and $37,000 in 1951, and wants to know what has caused the decline of $33,000. The following information was given by the company:

Net Sales	1950	1951
Product A	$100,000.00	$120,000.00
Product B	50,000.00	40,000.00
Product C	25,000.00	25,000.00
Total	$175,000.00	$185,000.00
Cost of Goods Sold	105,000.00	148,000.00
Gross Profit	$ 70,000.00	$ 37,000.00

The quantity and quality of raw materials entering into each unit of product have remained unchanged throughout the two years.

No inventories were on hand at the beginning or end of either year.

Scrap from the fabrication of Products A and B is the raw material for Product C. Product C has been treated as a by-product and the cost of raw material entering into it has been regarded as an amount equal to its selling price less the direct labor expended in making it a marketable product. This "cost" has been credited 4/5 and 1/5, respectively, to the material costs of Products A and B, for the reason that the proportion of scrap material from the fabrication of the two major products has been 4 to 1. Upon analysis of the books the following cost data were extracted from the production accounts:

Cost of Production in 1950:

	Units	Material	Labor	Overhead	Total
Product A	500	$40,000	$10,000	$10,000	$ 60,000
Product B	2,500	10,000	5,000	5,000	20,000
Product C	1,000	16,000	9,000	-	25,000
		$66,000	$24,000	$15,000	$105,000

Cost of Production in 1951:

	Units	Material	Labor	Overhead	Total
Product A	600	$60,000	$15,000	$15,000	$ 90,000
Product B	1,600	13,000	10,000	10,000	33,000
Product C	1,250	10,000	15,000	-	25,000
		$83,000	$40,000	$25,000	$148,000

Because of the confusion that would otherwise enter into the comparison, it was agreed with the management that the raw material in each unit of Product C manufactured and sold during both years should be considered as costing $8. It was also agreed to apply overhead to the three products on a direct labor cost basis.

Required: Prepare a statement showing to what extent the decline in the gross profit was attributable to changes in sales volume, prices, and production costs. Show computations of adjusted unit costs.

Note: 1. Treat overhead variances as if all overhead is variable.
2. Ignore the sales mixture.
3. Round off all computations to the nearest dollar.

(Adapted from an American Institute of Accountants examination)

26–2. *a*) Assume the following:

Present sales—$400,000
Variable cost—$.72 per sales dollar
Fixed cost—$84,000

Find the effect on profit of:

(1) A decrease of 25% in sales.
(2) An increase of 25% in sales.
(3) An increase of 50% in sales.

b) Same as (*a*) above except that the variable costs equal $.60 per sales dollar.

c) Assuming the same data as in (*a*), what is the effect on profit of:
  (1) An increase in sales price of 10%, other factors remaining the same?
  (2) A decrease in sales price of 10%, other factors remaining the same?

d) Assuming the same data as in (*a*), what is the effect on profit of:
  (1) An increase of 5% in the variable cost?
  (2) A decrease of 5% in the variable cost?

e) Assuming the same data as in (*a*), what is the effect on profit of:
  (1) An increase of 5% in the fixed cost?
  (2) A decrease of 5% in the fixed cost?

26–3. The Buchanan Manufacturing Corporation submits the following information relative to its operations for the year 19—:

Sales of 100,000 units (80% of capacity) at $10 each		$1,000,000.00
Variable costs	$600,000.00	
Fixed costs	280,000.00	880,000.00
Income before income taxes		$ 120,000.00

1. Determine the break-even point in terms of unit volume and as a percentage of capacity.

2. Assume this company changed to a Lifo basis of inventory thus increasing material costs by $20,000 and adopted a depreciation charge based on replacement cost thus increasing depreciation by $4,000. Compute the new break-even point and percentage of capacity to break even.

3. Assume the company adopts the Lifo basis and the replacement basis and proceeds to project operations for the next year. It is expected that variable costs will increase 5% and fixed costs 10% over the amounts in paragraph 2. above. Compute the break-even point and level of capacity to be achieved if

a) Sales prices do not change.
b) Sales prices increase 5%.
c) Sales prices increase 10%.

26–4. The X Club has decided to give a party. Plans call for the following expenditures:

Ballroom rental	$100.00
Orchestra	225.00
Decorations	75.00
Supper (per person)	2.00

Tickets are to be sold for $5 each and it is expected that 100 members will attend. One member has suggested that tickets be sold to nonmembers invited by members, but another objects, saying that the party is not self-supporting but is being paid for in part by subsidy from the club's treasury. Hence, he argues that the club is paying part of the cost of entertaining each nonmember who attends.

a) How much is the club paying from its treasury for the party?
b) Will it cost the club more or less if 30 nonmembers are invited and attend?

26–5. The most recent operating statement for a company shows the following data:

Unit price	$ 1.00
Unit sales volume	100,000
Dollar sales volume	$100,000.00
Variable costs	65,000.00
Contribution margin	$ 35,000.00
Fixed costs	30,000.00
Net profit before taxes	$ 5,000.00

A 10% increase in unit selling price has been suggested.

Required:

a) Determine (1) unit volume and (2) dollar volume necessary to maintain the present dollar profit.
b) Set up an operating statement showing expected results if unit volume should drop by 5% after the price increase.

26–6. The following data are given:

Maximum capacity	150,000 units
Variable charges	$.45 per unit
Fixed charges	$50,000
Unit selling price	$1.15 per unit

Required:

a) Compute the break-even point.
b) New break-even point if the selling price is cut to $.90 a unit, other factors remaining the same.
c) Volume required to yield a desired profit of $8,000.
d) New break-even point if fixed costs are reduced from $50,000 to $45,000.
e) New break-even point if the variable charges are reduced 10%.
f) What profit may be expected if budgeted sales of $161,000 are realized
  (1) When unit selling price is $1.15?
  (2) When unit selling price is $.90?

Note: Compute the break-even point in the above problems in dollars, physical volume, and per cent of capacity.

26–7. Assume the following facts:

Present sales volume	$180,000
Total fixed charges	$ 75,000
Variable unit cost	$ .55
Present unit selling price	$ 1.25

It is proposed to reduce the selling price to $1.05 a unit. How many additional units must be sold to maintain the same total profit as before?

26–8. Assume the following data:

	Product A	Product B
Selling price per unit	$ 2.30	$ 1.60
Estimated number of units	60,000	40,000
Variable charges per unit	$ .90	$ .70
Fixed charges	$30,000	$16,000

Required:

a) Compute the break-even point for each product.
b) Compute the over-all break-even point. Is it equal to the sum of the break-even points for Products A and B? Why or why not?

26–9. You have received the following letter from a client. You are asked to write an answer to his inquiry:

THE DAVIS MANUFACTURING COMPANY

New York, New York
May 24, 19—

Dear Sir:

I am writing to you to see if you can give us some help in a problem that we encountered last week when establishing a break-even point for our company as a whole, and for individual divisions of the business. Briefly stated the problem is as follows:

1. We established the break-even point for the company based on the usual formula of establishing fixed costs and variable costs, and dividing the fixed costs by the sales profit ratio.
2. Since our business is subdivided into some thirty separate divisions, we then established separate break-even points for each division of the business.
3. We found that the sum of the break-even points for each separate division of the business would not add up to the total break-even point as shown by the company.

The required sales volume to reach the separate divisional break-even points exceeded by a rather substantial figure the over-all company break-even point.

This problem must have been faced by other companies who have established break-even points, and who have a divisional breakdown of their business. Any help you can give us or any answers you can furnish will be greatly appreciated.

Very truly yours,
THE DAVIS MANUFACTURING COMPANY

Robert Johnson
Controller

26–10. The Anti-Bug Screen Company is a manufacturer of insect wire screening. The manufacturing process consists of the weaving of steel wire cloth (screening) on looms, and the subsequent galvanizing, painting, and wrapping of the woven wire cloth. The weaving wire used in the weaving process, for the most part, is purchased from outside suppliers, but the company also operates a wire drawing mill, in which wire of a larger diameter (drawing wire) is converted into weaving wire and used only with purchased wire in the wire cloth mill.

No segregation between the operation of the wire cloth mill and the wire drawing mill appears in the operating ledger, a trial balance of which at December 31, 19— is as follows:

Inventories, January 1, 19—:		
Weaving Wire—1,400,000 lbs. at $.10	$ 140,000.00	
Drawing Wire—40,000 lbs. at $.06	2,400.00	
Material in Process—400,000 lbs. at $.10	40,000.00	
Labor and Overhead in Process	8,000.00	
Finished Stock, 3,800,000 sq. ft. at $.02½	95,000.00	
Finishing Materials	5,000.00	
Wrapping Materials	10,000.00	
Wire Drawing Mill Dies	3,000.00	
Fuel	1,500.00	
Direct Labor	330,000.00	
Indirect Labor	200,000.00	
Maintenance Labor	55,000.00	
Purchases:		
Weaving Wire—12,600,000 lbs. at $.13	1,638,000.00	
Drawing Wire—760,000 lbs. at $.08	60,800.00	
Finishing Materials	202,000.00	
Wrapping Materials	28,000.00	
Wire Drawing Mill Dies	16,000.00	
Fuel	5,500.00	
Maintenance Supplies and Expenses	33,000.00	
Power and Water	50,000.00	
Miscellaneous Factory Expense	33,000.00	
Depreciation	22,000.00	
Property Taxes	2,000.00	
Insurance	12,000.00	
Social Security Taxes	10,000.00	
Royalties	9,000.00	
General Ledger Controlling Account		$3,011,200.00
	$3,011,200.00	$3,011,200.00

Inventories at December 31, 19— were as follows:

	Quantity	Average Cost or Market, Whichever Is Lower
Weaving wire	1,300,000 lbs.	$165,000.00
Drawing wire	50,000 lbs.	3,950.00
Finishing materials		7,000.00
Wrapping materials		8,000.00
Wire drawing mill dies		4,000.00
Fuel		2,000.00
Material in process		70,000.00
Labor and overhead in process		10,000.00
Finished stock	2,000,000 sq. ft.	*

* To be computed; round off unit cost in fourth decimal place.

ADDITIONAL INFORMATION:

An annual average cost is used by the company in pricing all inventories. Such annual average includes beginning inventories plus purchases or production.

Finished weaving wire is produced in the wire drawing mill in one operation, and requires no finishing or wrapping. There was no drawing wire inventory in process at the beginning or end of the year.

It may be assumed that the wire drawing mill expenses approximate 10% of the total of each applicable classification of cost, including royalties.

Production for the year was as follows:

Wire drawing mill—700,000 lbs. of weaving wire
Wire cloth mill—88,205,000 sq. ft. of wire cloth

Required: Prepare, in columnar form, a statement of cost of sales, showing individually and in total the wire drawing mill and wire cloth mill costs of manufacturing. Submit computations.

The effect of the excess cost, if any, of produced weaving wire over purchased weaving wire may be disregarded in your determination of the value of finished goods inventory.

CHAPTER 27

27–1. Company A and Company B are engaged in the production and sale of crude oil. On January 1, 1952, Company A acquired from Company B a 20-year leasehold on a certain undeveloped property on the following terms:

1. Of the oil produced, 12½% is to be delivered to Company B as royalty.
2. On the remaining 87½% Company A is to pay Company B $.25 per barrel until the total so paid has aggregated $700,000. The latter sum is understood to be the purchase price of the lease and must be

paid unless the geologists' estimate of the total oil underground capable of being produced is less than 3,200,000 barrels. In that event the purchase price will be proportionately reduced.

3. To ensure development of the property, Company A is to keep one string of drilling tools in continuous operation until January 1, 1962, or pay a penalty to Company B for idle periods, calculated on the basis of $50,000 for a whole year's cessation of drilling operations.
4. Company A is to pay the land rentals, which amount to $75,000 per annum payable in advance and are due on January 1 of each year.
5. Company A may discontinue development and abandon the leasehold at the end of ten years, upon which any unpaid balance of the purchase price of the lease will become due and the property, with all its development and equipment, reverts to Company B.

During 1952 Company A drilled continuously and expended $630,000 for drilling, construction of field lines, and other work in the field, and produced 648,000 barrels of oil, which were all sold or delivered within the year. Company A realized an average of $1 per barrel on the sales of crude oil and all costs of producing and handling amounted to $.40 per barrel on its own share of the oil produced, before depletion and land rentals.

It was agreed by the geologists of both companies that on January 1, 1952, the oil underground capable of being produced from the wells existing on December 31, 1951, aggregated 2,400,000 gross barrels and that it will require ten years to produce it.

They also estimated that on January 1, 1952, the total oil reserves in the property amounted to 8,000,000 gross barrels and that, with an expenditure of $1,600,000 for additional wells and facilities, this oil can be produced during the life of the lease. The latter sum includes the estimated cost of keeping one string of drilling tools in continuous operation.

Company A, having in the meantime acquired other properties which produce crude oil of higher quality at lower cost, sought to revise the agreement. Company B offered to reduce, commencing January 1, 1953, the penalty for failure to continue drilling operations to $10,000 per annum, to operate the property using the existing wells and facilities, or any additional wells and facilities, to keep them in good operating condition, and to deliver to Company A its share of the crude oil for $.35 per barrel. In other respects the terms of the contract were to remain the same.

Company A will charge depletion on the basis of actual exhaustion of the estimated oil reserves, without regard to the discovery value and percentage depletion clauses in the federal income tax law.

a) What entries should be made by Company A on January 1, 1952?

b) What is the gross profit or loss of Company A on the crude oil produced and sold in 1952?

c) Which of the following alternatives will be the most advantageous to Company A, assuming that operating costs and sales prices remain the same, and that the wells and equipment have no salvage value:

(1) Not to accept Company B's offer and to continue production and development.

(2) Not to accept Company B's offer and to continue production, but to discontinue development.

(3) Not to accept Company B's offer and to discontinue production as well as development.

(4) To accept Company B's offer and to continue development.

(5) To accept Company B's offer and to discontinue development.

(*Adapted from an American Institute of Accountants examination*)

27–2. During October and November, 1952, the plant superintendent of the ABC Products Company (a subsidiary of the XYZ Manufacturing Company, Inc.) reorganized the processes in one of his most important departments, chiefly by installing up-to-date automatic machinery. As a result of such reorganization, the monthly production has been increased by 25% as compared with corresponding periods of the previous year, but the ratio of factory overhead to direct labor increased from 25% to approximately 41%.

The general manager of the parent company has forwarded to the president of the XYZ Manufacturing Company, Inc. an official criticism of the plant superintendent and of the reorganization made by him. The criticism is based on the increased percentage of overhead to direct labor. The president has asked you to investigate the matter and report to him. You find the facts to be as follows:

	Data for three months ended March 31			
	1952		1953	
Production costs:	Per Cent of Sales Value	Dollar Amounts	Per Cent of Sales Value	Dollar Amounts
Cost of direct material used	25	$112,500.00	27	$153,000.00
Cost of direct labor expended	50	225,000.00	29	164,000.00
Cost of manufacturing overhead	12.5	56,250.00	12	67,000.00
Value, at sales prices, of finished goods produced (which were readily salable)	100	450,000.00	100	562,000.00

The production process of ABC Products Company is short and no consideration need be given to material in process.

Prepare a condensed summary and explanation such as you would include in your report, based on the foregoing figures, which will demonstrate the actual results accomplished by the plant superintendent's reorganization.

(*Adapted from an American Institute of Accountants examination*)

27–3. The City Dairy Company bottles and distributes milk. Its sales average 40,000 lbs. per day. It operates three pasteurizers, having a capacity of 2,500 lbs. each per hour.

These machines cost $1,200 apiece installed and they have been in use three years. Their estimated life when installed was 15 years and estimated salvage value at the end of that period $50 each. Repair and maintenance charges on these machines will average 3% of their cost per year.

The Smith Dairy Machinery Company manufactures a new type of machine which is guaranteed to have a productive capacity of 12,000 lbs. per hour and to save 80% of the cost of live steam and refrigeration used in pasteurization as compared with the old type. The life of these machines is estimated at 10 years and their salvage value at the end of that period at $100 each. The manufacturers offer to install them ready to operate at $8,500 each, and to remove the old machines and allow for them their estimated scrap value. Their guarantee also provides for replacement of broken or defective parts and complete maintenance to keep their machines in good working order for one year. Subsequent repair and maintenance charges may be assumed to average 5% of the machine's original cost annually.

You are called upon to make a special examination of the accounts to determine whether it would be advantageous from a profit and loss standpoint to install the new type of machine. Your examination discloses that the present cost of live steam and refrigeration used in pasteurization averages 44¢ per 1,000 lbs. of milk.

Required: Assuming future production to average 5% greater than the sales given above, state the conclusions you would report to your client and show the method of arriving at them.

27–4. From the following data, determine whether the new product should be placed in production as a means of increasing sales.

1. Normal monthly costs for present production:

Direct labor	$100,000.00
Overhead	200,000.00

2. Estimated monthly cost (additional) for new line:

Direct labor	50,000.00
Overhead	50,000.00

3. The new product line will employ the same facilities as the present product lines.

4. Added direct labor cost of $50,000 will increase total overhead expenditures by only $50,000. The same thing would hold if volume on the old lines were to be increased 50%.

5. The old lines have a standard selling and administrative overhead rate of 10% of factory cost. The new line will increase their expenses $5,000 per month.

6. Direct material cost per month for new line, $25,000.

7. Estimated sales of new line per month, $156,000.

27–5. The Keller Manufacturing Company produces a line of novelties. The standard selling price to the trade is $.14 net, each. The 1953 budget forecast is as follows:

	Quantity 60% of Capacity	Unit Price or Cost	Total
Sales income	10,800,000	$.14	$ 1,512,000.00
Standard costs and expenses:			
Direct material		.040	
Direct labor		.021	
Factory overhead		.030	
Selling expense		.014	
Administrative expense		.007	
Volume variances:			
Factory overhead underapplied			36,000.00
Selling expense underapplied			16,200.00
Administrative expense underapplied			12,600.00

The factory overhead is applied at a standard rate of $.03 per unit of which $.01 is variable and $.02 fixed. Similarly, selling expense is composed of $.005 variable and $.009 fixed expense. Administrative expense may be considered as wholly fixed.

A chain store buyer offers to buy an additional 2,700,000 at a discount of 12½% off list price.

Required:

a) At what point (percentage of capacity) will the fixed charges be completely absorbed? At what capacity will the plant operate if the offer is accepted?

b) Complete the 1953 budget forecast. What is the expected profit at 60% of capacity?

c) Prepare a complete budget forecast for 1953 on the basis of the additional volume. Should the company accept the new offer?

d) Prepare an analysis on the basis of marginal revenue and expense to show whether the new offer should be accepted.

27–6. The Handee Gadget Company manufactures a product which costs:

Fixed (per month)	$1,000.00
Variable (per unit)	.10

Sales are currently 10,000 units per month at $.30 per unit. The company's sales manager proposes that the company should sell in a foreign market where demand for an additional 5,000 units per month is expected. However, in order to do this it will be necessary to absorb additional shipping costs and duties amounting to $.12 per unit.

a) Will the foreign business be profitable?

b) A domestic chain store has offered to take 5,000 units per month at $.18 per unit. Should this order be accepted in place of the foreign order?

c) The sales department proposes that the selling price of the company's product be reduced to increase sales. It submits the following estimates of sales volume anticipated at various prices.

30¢ per unit (present price)	10,000 per month
25¢ per unit	14,000 per month
20¢ per unit	19,000 per month

(1) Assuming the above estimates are correct, should the price be reduced?

(2) What effect will price reduction have on rate of profit on sales?

27-7. The Long Valve Company has been exclusively engaged in the manufacture of valves for the Supreme Plumbing Fixture Company. The Supreme Plumbing Fixture Company desires to change its line of product and has asked The Long Valve Company to quote it a price on a new type valve made of an entirely different material from that used in the valve presently being produced. The Long Valve Company has been operating at 100% of capacity and it is contemplated that operations will continue at a 100% rate during the production of the new type valve.

A statement of operations for the year just ended is set forth below:

Net Sales		$960,000.00
Cost of Sales:		
Materials	$550,000.00	
Direct Labor	125,000.00	
Indirect Labor	50,000.00	
Social Security Taxes (4%)	7,000.00	
Compensation Insurance (1%)	1,750.00	
Real Estate Taxes	5,250.00	
Fire Insurance	8,000.00	
Depreciation on Building	3,500.00	
Depreciation on Machinery and Equipment	13,900.00	
Machinery and Building Repairs	4,800.00	
Heat, Light, and Power	2,300.00	
Factory Supplies and Expenses	47,500.00	819,000.00
		$141,000.00
Administrative Expense:		
Officers' Salaries	$ 12,000.00	
Office Salaries	18,000.00	
Office Supplies and Expense	4,500.00	
Capital Stock Taxes	6,000.00	
Social Security Taxes	1,200.00	
Compensation Insurance	300.00	
Depreciation on Office Equipment	3,000.00	45,000.00
Profit from Operations		$ 96,000.00

The new valve will have a material cost of $18 per unit and a direct labor cost of $17 per unit. (The new direct labor costs were computed on a piece-rate basis and spoilage loss is insignificant.) It is estimated that the annual direct labor cost will increase by $25,000 and indirect labor cost $15,000. Additional machinery having a cost of $41,000 and a ten-year life will be needed to produce the new valve. The change will also require an increase in average material inventories of $59,000. Fire insurance rate on buildings and contents is $2 per $1,000 of value. Power costs will increase $700, machinery repairs $200, and factory supplies and expense will increase $13,800. Administrative costs will remain the same. No employee earns more than $3,600 per year.

Required: Determine the unit selling price required to yield the same rate of profit from operations to sales.

(Adapted from a Pennsylvania C.P.A. examination)

27–8. The Jones Department Store operates ten separate retailing departments, two of which, X and Y, have incurred operating losses for the past several years. In discussing the 1953 operating results with the president, Mr. Jones, the following audited income statements of Departments X and Y are reviewed:

	Department X	Department Y
Net Sales	$336,000.00	$143,000.00
Cost of Goods Sold	224,000.00	92,000.00
Gross Profit	$112,000.00	$ 51,000.00
Operating Expenses		
Advertising, Direct	$ 8,800.00	$ 10,400.00
Accounting Office Expense	17,400.00	9,200.00
Amortization, Leasehold Improvements	4,000.00	3,000.00
Bad Debts, Actual	1,900.00	850.00
Depreciation, Department Furniture and Fixtures	2,000.00	1,450.00
Express and Freight Outward	4,200.00	3,300.00
Insurance, Direct	1,000.00	650.00
Occupancy and Maintenance Expense	8,400.00	6,200.00
Publicity Department Expense	6,600.00	5,400.00
Rent, Building	4,000.00	3,000.00
Salaries, Sales Clerks	33,000.00	29,200.00
Salary, Department Buyer	8,000.00	9,000.00
Salaries, General Executives	7,200.00	2,000.00
Shipping Department Expense	21,000.00	3,000.00
Taxes, Direct	2,400.00	1,850.00
Traveling Expense, Department Buyer	3,000.00	2,800.00
Total Operating Expenses	$132,900.00	$ 91,300.00
Net Operating Loss, 1953	$ 20,900.00	$ 40,300.00

Mr. Jones states that since concentrated effort has failed to eliminate or reduce the recurring losses in the two departments, he has about decided to recommend that Departments X and Y be discontinued. He asks that you advise him what effect the elimination of Departments X and Y would have had on the company's total operating income (before income taxes) of $150,000.00 for the year 1953.

The Jones Department Store operates in a rented building under a lease (with renewal option) that expires on January 1, 1960. The leasehold improvements are being amortized over the term of the current lease. Each retailing department of the store operates as a distinct unit and is charged with direct expenses incurred by it, as well as for its proportionate share of service departments expenses and other overhead.

No appreciable loss would be realized from disposal of the merchandise inventories and furniture and fixtures of either Department X or Y.

In determining what effect the elimination of Departments X and Y would have had upon the total expenses of the four service departments, you reach the conclusion that these 1953 expenses would have been reduced by the following amounts:

	Department X Eliminated	Department Y Eliminated	Both Departments Eliminated
Accounting Office	$ 7,500.00	$4,500.00	$12,000.00
Publicity Department	4,000.00	3,000.00	7,000.00
Shipping Department	10,000.00	1,000.00	11,000.00
Occupancy and Maintenance Department	2,000.00	None	2,000.00
Totals	$23,500.00	$8,500.00	$32,000.00

Required: Present statements for Departments X and Y showing what effect the elimination of each department would have had on the total 1953 operating income of $150,000.

Note: Ignore income tax effect.

(Adapted from a Pennsylvania C.P.A. examination)

27–9. The Collins Company manufactures and sells 8,000,000 units of product a year. Production involves material preparation which requires the services of one man. The forming operation takes place on four hand-operated forming presses, each press served by one man. It is proposed to replace the entire process, both material preparation and forming, by one fully automatic machine costing $50,000 with a life expectancy of five years.

The following comparative data are submitted for your consideration:

HAND FORMING

	Rate	Total
Labor—Material Preparation (per 1,000 units)	$ .24	$ 1,920.00
—Forming (per 1,000 units)	1.56	12,480.00
Total labor	$1.80	$14,400.00
Applied overhead 140% of direct labor	2.52	20,160.00
Total labor and overhead	$4.32	$34,560.00

The overhead is based on the following estimates:

Press hours per year—4 presses		8,000
F.O.A.B. tax based on 1st $3,600 of earnings		$ 216.00
Other payroll taxes (vacation pay, retirement insurance, etc.)	8%	1,152.00
Tool costs		1,513.00

	Rate	Total
Power (10 kw. per machine hour), Rate per machine hour	$ .02	$ 1,600.00
Maintenance		4,000.00
Depreciation		2,400.00
Floor space costs		1,600.00
Indirect labor and related costs (move men, janitor, etc.)		4,079.00
Apportioned costs		
Supervision and clerical		1,200.00
Works general		2,400.00
Total overhead		$20,160.00

The automatic press requires one operator paid at the rate of $.45 per 1,000 units. Tool costs are estimated at $4,560; the machine uses 15 kw. per hour, and maintenance is estimated at $5,500 per year.

Required: Prepare an analysis to show whether the existing equipment should be replaced by the automatic machine.

27–10. Bogen Distributors, Inc. are planning to add a new product to their existing facilities. The engineering department has advised the general manager that adequate service facilities exist to provide power, maintenance, etc., to take care of the new line. The cost department has presented the following cost data:

Direct material	$ .08
Direct labor	.045
Variable overhead	.065
Fixed overhead of plant	75,000.00
Fixed overhead applicable to new department	15,000.00

Space for the manufacture of the new line is available, but a foreman will have to be hired at a salary of $4,200 a year. In addition, new machines costing $5,000 will be necessary; they have an estimated ten-year life. Special tools costing $5,000 will be required, with an estimated life of 3½ years. The sales department advises they can sell 1,600,000 units a year at $.23.

Required: What is your advice? Give reasons and explain limitations.

27–11. A company operating a factory manufacturing neckwear and shirts has been offered a contract for the making (only) of 2,000 dozen shirts at a price of $3.75 per dozen. All materials are to be supplied free by the concern offering the contract.

You are informed that this contract could be handled with the present equipment and without any effect on the producing or marketing of their regular lines. You are also informed that the additional expenditures that would be incurred by accepting this contract are estimated as follows:

1. Piecework wages at same average rate as paid in previous year.
2. An additional cutter would be required for a period of ten weeks at $30 per week. Cutters are not on a piecework basis.
3. Additional factory expenses, $500.
4. Allowance for contingencies, etc., $500.

The following information is obtained from the company's last annual statement and from other records (the experience of this single year is quite average in relation to earlier periods and to the industry generally):

	Neckwear Dept.	Shirt Dept.
Sales	$155,000.00	$270,000.00
Materials Used	94,500.00	172,500.00
Wages, Piecework	18,000.00	27,000.00
Wages, Day Work, Productive	5,000.00	10,000.00
Depreciation of Equipment, etc.	750.00	900.00
Total Distributed Expenses	$118,250.00	$210,400.00

Undistributed Expenses:	
Wages, Unproductive	$ 10,500.00
Wages, Shipping	1,800.00
Factory Expenses	7,250.00
Factory Stationery	750.00
Advertising	5,750.00
Rent	4,500.00
Interest and Bank Charges	3,250.00
Office Expenses	6,300.00
Office and Management Salaries	15,200.00
Bad Debts	2,500.00
Salesmen's Commissions	17,280.00

Floor Space, Neckwear Department	2,800 sq. ft.
Floor Space, Shirts Department	5,700 sq. ft.
Floor Space, Office and Shipping Department	500 sq. ft.
Total	9,000 sq. ft.

Salesmen are paid the same commission per dozen neckwear or shirts. It is estimated that the production for the coming year, excluding this proposed contract, will be the same as during the year just ended, i.e., neckwear 18,000 dozen, shirts 15,000 dozen.

State whether or not you would recommend accepting this contract, giving reasons and figures.

(Adapted from a Canadian Chartered Accountant examination)

27-12. The D. P. Manufacturing Company produces one principal product. The income from sales of this product for the year 1953 is expected to be $200,000. Cost of goods sold will be as follows:

Materials used	$40,000.00
Direct labor	60,000.00
Fixed overhead	20,000.00
Variable overhead	30,000.00

The company realizes that it is facing rising costs and in December is attempting to plan its operations for the year 1954. It is believed that if the product is not redesigned the following results will be obtained:

Material prices will average 5% higher and rates for direct labor will average 10% higher. Variable overhead will vary in proportion to direct labor costs. If sales price is increased to produce the same rate of gross profit as the 1953 rate, there will be a 10% decrease in the number of units sold in 1954.

If the product is redesigned according to suggestions offered by the sales manager, it is expected that a 10% increase can be obtained in the number of units sold with a 15% increase in sales price per unit. However, change in the product would involve several changes in cost.

A different grade of material would be used but 10% more of it would be required for each unit. The price of this proposed grade of material has averaged 5% below the price of the material now being used and that 5% difference in price is expected to continue for the year 1954. Redesign would permit a change in processing method, enabling the company to use less skilled workmen. It is believed that the average pay rate for 1954 would be 10% below the average for 1953 because of that change. However, overhead is incurred directly in relation to production. It is expected to increase 10% because of price changes and to increase an additional amount in proportion to the change in labor hours.

Assuming the accuracy of these estimates, you are to prepare statements showing the prospective gross profit if:

a) The same product is continued for 1954.
b) The product is redesigned for 1954.

(Adapted from an American Institute of Accountants examination)

27–13. Atomic Toys, Inc. produces a series of children's toys. The business is highly seasonal, with a peak in the winter months and very low sales in the summer. Hence the company is faced with the necessity of deciding whether to keep production more or less level through the year or follow the sales curve.

The forecast for 1953 indicates a sales volume of 50,000 units, and management does not want to produce more than can be sold during the year. The plant closes two weeks for vacations in July and, during this period, the men are paid their regular base rates determined by the shift on which they work. The company has an insured pension plan under which its premium is 2% of total wages and salaries. Because of a state unemployment tax experience rating credit, the tax rate is 2% if shifts are added and taken off during the year, but only 1% if level production is maintained.

Salaried personnel is not dropped if production falls to a one-shift level, but extra supervisors and timekeepers are added temporarily when a third shift is worked. These extra salaries amount to $29,400.

The storeroom has a maximum capacity of 2,000 units. If production and sales are kept in step, this space is adequate. If production is kept even, additional warehousing rental becomes necessary at a monthly cost of $300.

SCHEDULE A

Production per 8-hour shift—100 units (125 men per shift, 10 man hours per unit)
Labor rates—Base rate $1.25 per hour 7 A.M.- 3 P.M. shift
1.30 per hour 3 P.M.-11 P.M. shift
1.35 per hour 11 P.M.- 7 A.M. shift

	Production Following Sales Curve						Level Production				
	Working Days	Shifts per Day	Production	Sales	To Stock	From Stock	Shifts per Day	Production	Sales	To Stock	From Stock
January	21	2	4,200	4,000	200		2	4,200	4,000	200	
February	20	2	4,000	4,000			2	4,000	4,000		
March	23	2	4,600	4,000	600		2	4,600	4,000	600	
April	20	2	4,000	3,000	1,000		2	4,000	3,000	1,000	
May	22	1	2,200	3,000		800	2	4,400	3,000	1,400	
June	22	1	2,200	2,000	200		2	4,400	2,000	2,400	
July	10	1	1,000	1,000			2	2,000	1,000	1,000	
August	23	1	2,300	1,000	1,300		2	4,600	1,000	3,600	
September	20	2	4,000	4,000			2	4,000	4,000		
October	22	(A) 3	7,800	8,000		200	2	4,400	8,000		3,600
November	21	(A) 3	7,500	8,000		500	2	(C) 5,000	8,000		3,000
December	20	(B) 3	6,200	8,000		1,800	2	(D) 4,400	8,000		3,600
	244		50,000	50,000	3,300	3,300		50,000	50,000	10,200	10,200

(A) Also 12 shifts on Saturdays—1,200 units production
(B) Also 2 shifts on Saturdays— 200 units production
(C) Also 8 shifts on Saturdays— 800 units production
(D) Also 4 shifts on Saturdays— 400 units production

The excess units must be moved to and from the rented warehouse at a cost of $.10 per unit each way.

Additional details concerning production, sales, and warehousing are given in Schedule A.

Required: From the above data and those given in Schedule A (page 728), prepare a statement of comparative costs, showing which course management should follow.

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